

2009 Roads and Bridges Conference

GW-7

Geometric Design V8i SELECTseries 1

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In this workshop, you will construct a roadway interchange horizontal layout utilizing the Civil Platform Geometry tools. Civil Platform Geometry is a dynamic, interactive, rules based approach to geometry that provides an unprecedented level of associativity by preserving design intent, snaps and Civil Accudraw input. The results of the tools are intelligent graphic elements which can be dynamically edited and associations between elements are automatically updated.

The results of the tools are graphical geometry elements stored in Microstation elements. There is no external geometry file. The geometry elements are Microstation elements with additional intelligence applied to store the rules and associations.

The Civil Platform Geometry tools are installed as a part of GEOPAK, InRoads and MX products. In order to be consumed by processes within GEOPAK, InRoads and MX, the civil platform geometry must be written to the native application cogo file (alg, gpk or fil). This is handled automatically. Elements are written to and updated in native cogo databases based on properties of feature definitions.

Prerequisite Knowledge Level: Participant should have a basic understanding of road design principles and be **fluent** in use of Microstation.

Lesson Name: Review Base Data

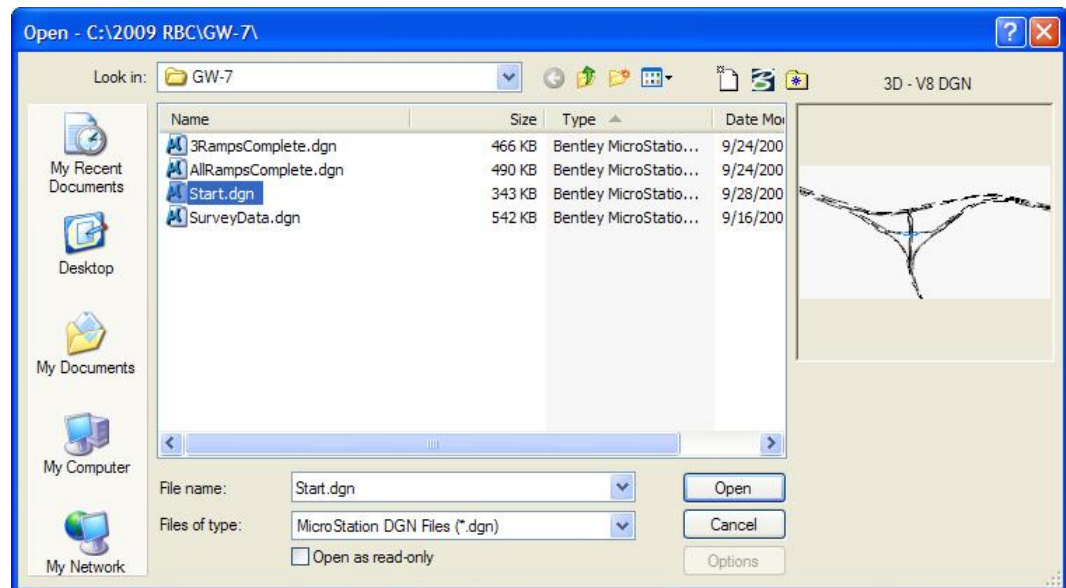
LESSON OBJECTIVE:

In this lesson we will open a DGN file and briefly review the conditions and constraints of our project. Our project in this workshop is the construction of a trumpet type interchange in a semi rural area. In this workshop we will construct a mainline alignment, a cross-road alignment and 4 ramps with their gore areas. Throughout the process we will evaluate design alternatives and/or correct errors by use of the manipulators available in the toolset as opposed to deleting and rebuilding the elements.

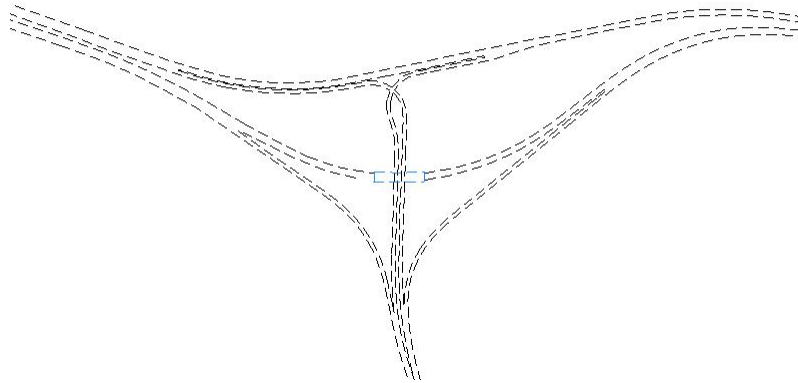
EXERCISE: OPEN AND REVIEW DESIGN FILE

To get an idea of the end goal of our work today, we will review the starting data and take a look of the ultimate result of our work.

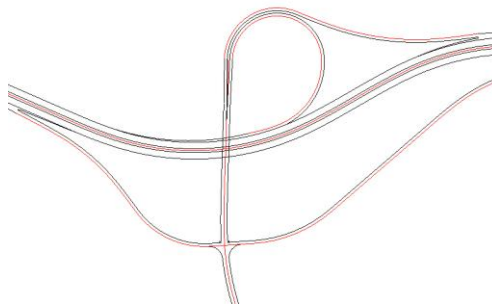
1. Start Microstation.



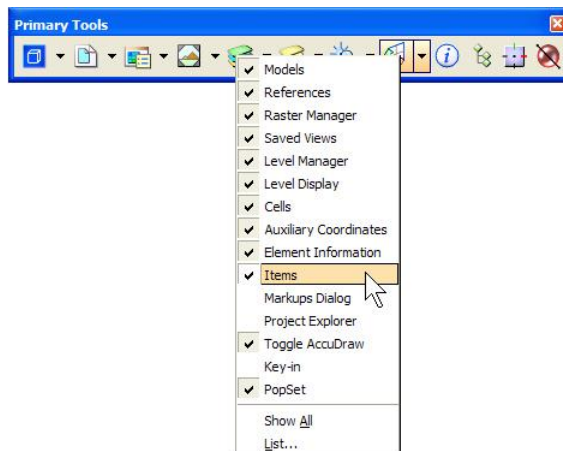
2. Open file C:\2009 RBC\GW-7\Start.dgn.



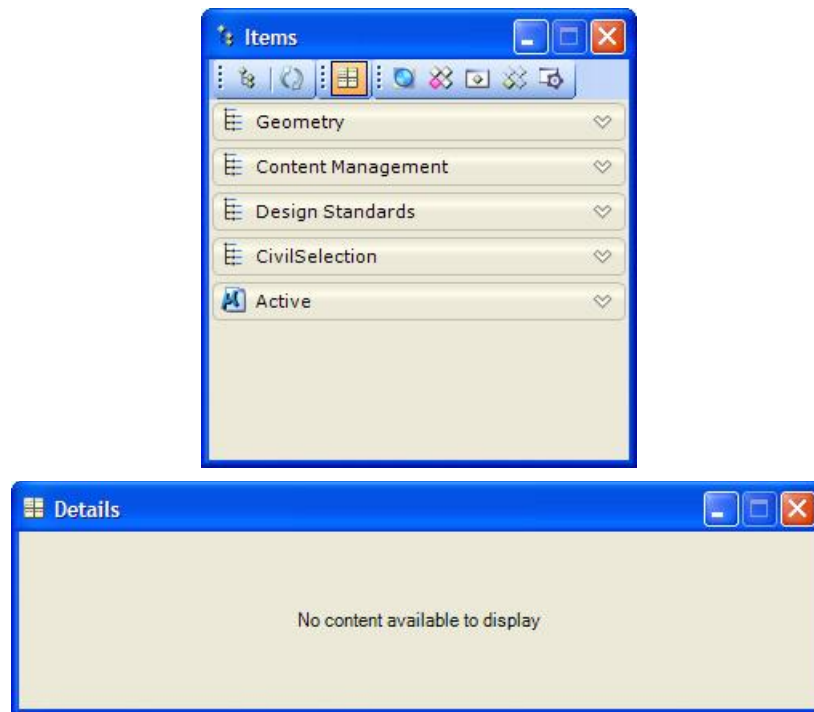
3. The data seen is in a reference file called **SurveyData.dgn** and will serve as a reference for our new geometric layout.
4. Now, open file named **AllRampsComplete.dgn**. This shows the layout we will be constructing.



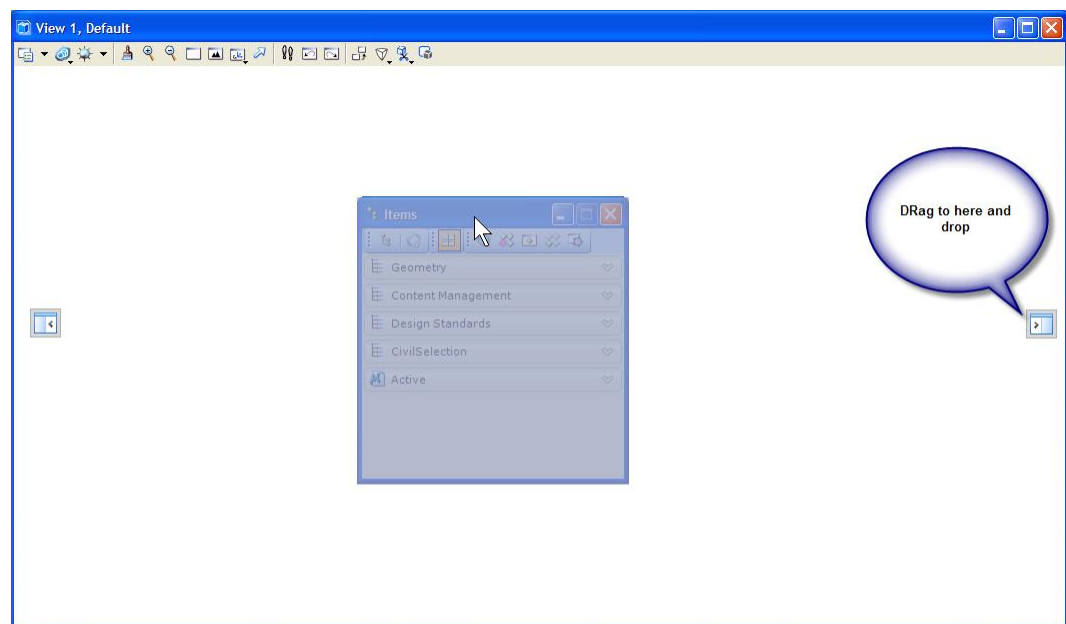
5. Now, let's do some preliminary interface setup for some items we will need later. First let's open the **Items** browser.
6. On the **Primary toolbox** right click and make sure the check mark is **ON** for the **Items** Browser.



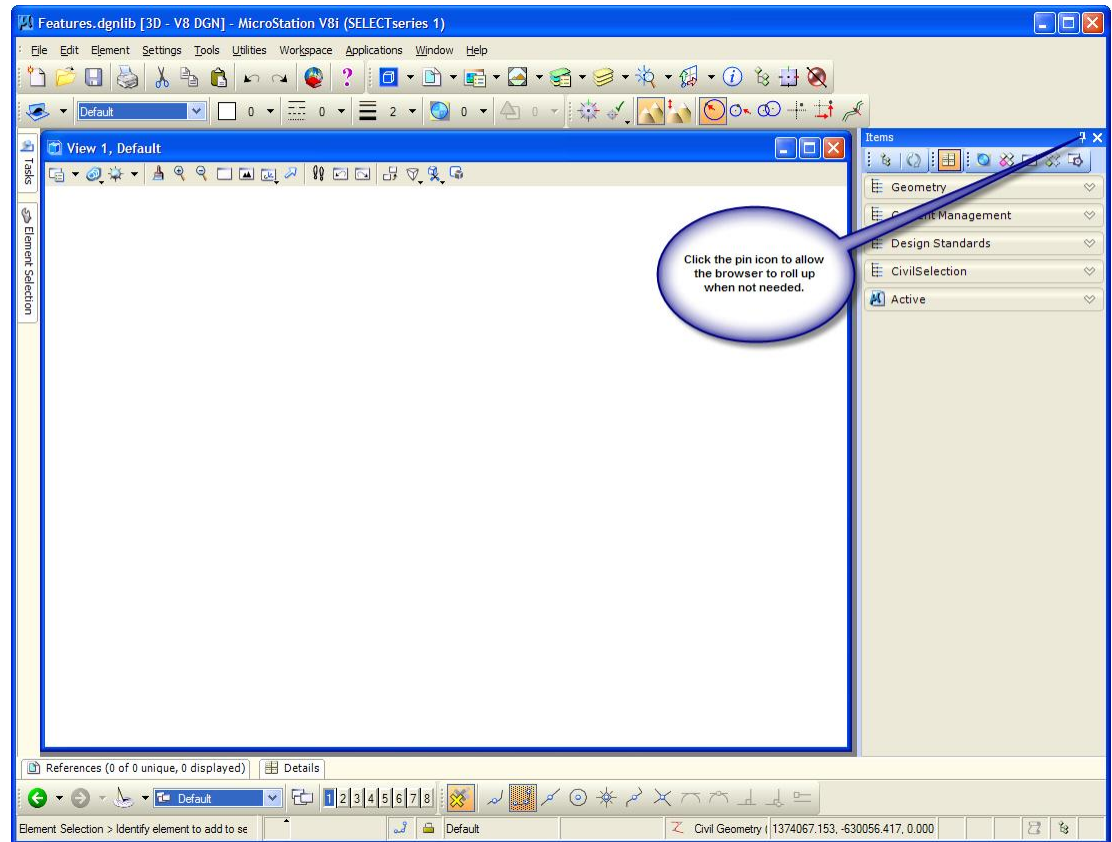
7. Now click on the **Items Icon** to open the browser. (The items browser consists of two parts, the browser tree and the browser details.)



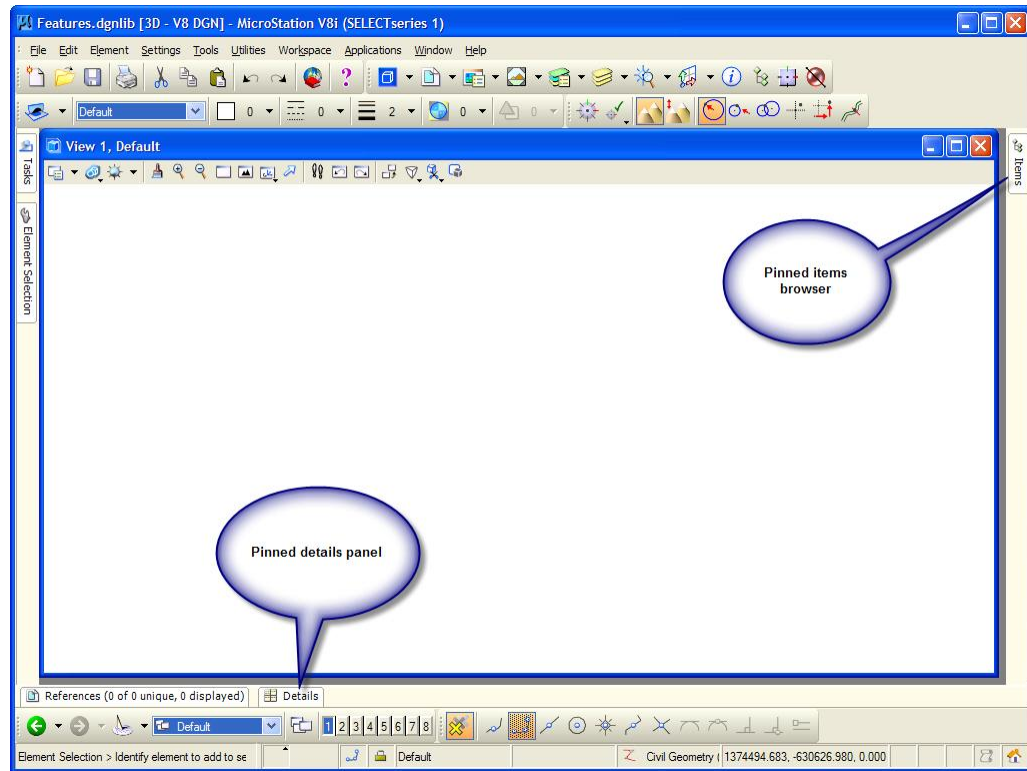
8. Now we can dock the browser tree to right hand side of screen.



9. Using the **pin icon**, we can set the panels so they roll up when not needed.

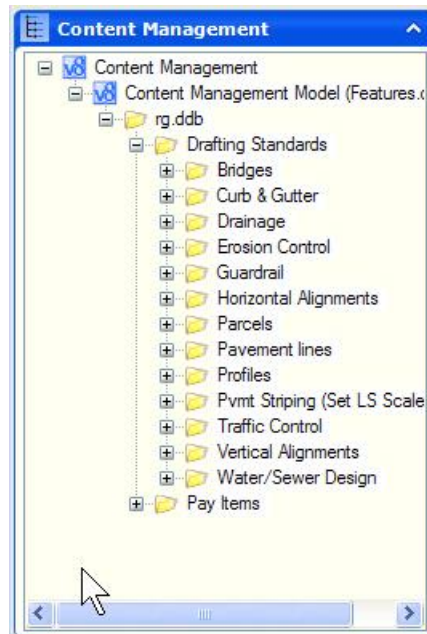


10. Dock and pin the Details to bottom of screen.

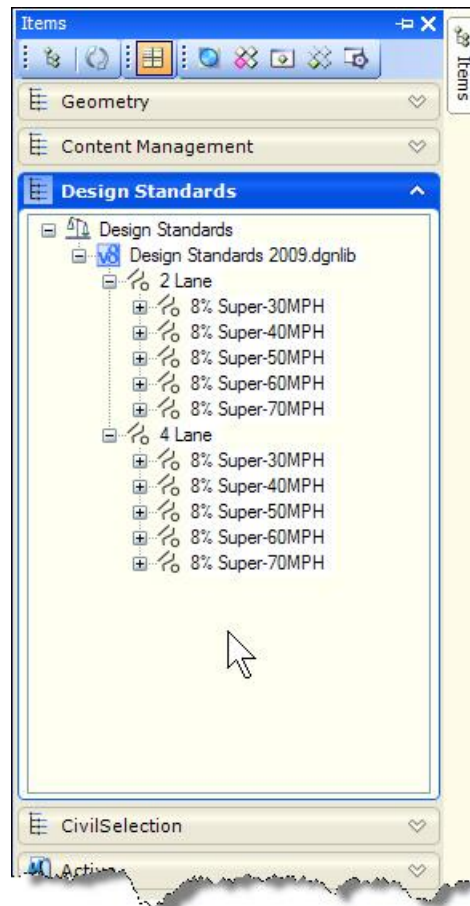


11. We will use these browser panels in the later exercises.

12. In the **Items Browser > Content Management** panel notice that we have some feature definitions available for our use. These are derived from a GEOPAK DDB file but InRoads XIN and MX PSS files are also supported. (See Appendix A for instructions of creating a dgnlib for use in your organization.)



13. In the **Items Browser > Design Standards** panel notice that we have some design standards available for our use. (See Appendix B for instructions of creating a dgnlib for use in your organization.)



Lesson Name: Create the Mainline Center Line

LESSON OBJECTIVE:

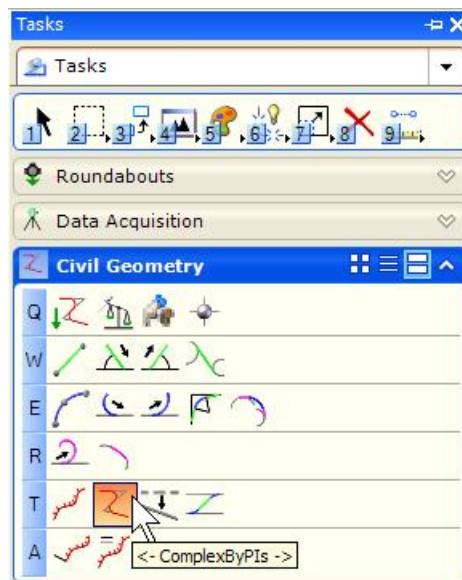
In this lesson we will utilize the design standards and feature definitions to construct a centerline for our mainline roadway.

EXERCISE: CREATE THE CENTERLINE

We will use the Complex By PI command for this exercise.

14. Open Microstation and open the file **Start.dgn**.

15. The Civil Platform Geometry tools are located on the task navigation in group named "Civil Geometry"



16. We will use the **Complex By PI** tool to create our alignment. (Fourth row down second icon from left.)

Create Complex Element By PI

Radius 0.000

Back transition

Geometry Spiral
Method Length
Length 0.000

Ahead transition

Geometry Spiral
Method Length
Length 0

Feature

Use Feature ☐
Feature Definition <Active Feature>
Name Prefix CL

17. The dialog will open but may look different than above. If you do not see the back and ahead transition panels in the command then set them to spiral for geometry type and length for method.

18. Note also that you have a prompt at the cursor.

Enter First PI

Radius 0.000

19. The Civil Platform is designed to provide heads up feedback so as to minimize the need for a command dialog. This keeps your focus on your work instead of having to divert your attention to a dialog.

20. Note the double arrows at the right side of the prompt. This is your cue that there are additional items that can be input. **Click the right arrow key** on keyboard and the prompt changes to back transition length.

Enter First PI

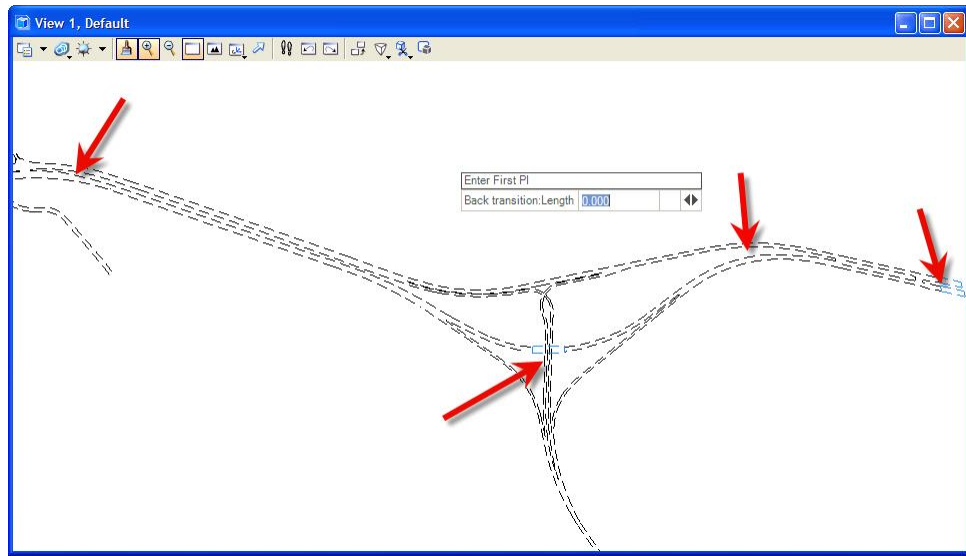
Back transition:Length 0.000

21. **Click right arrow again** and the prompt changes to ahead transition length. Click a third time to cycle back to radius prompt.

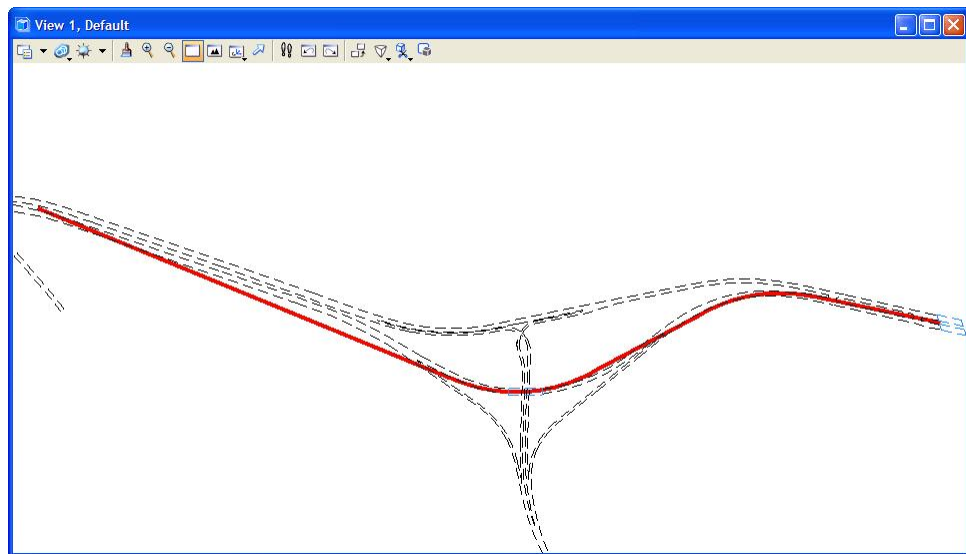
Note: For remainder of this workshop we will reference only the onscreen prompts except for those cases where the dialog is required.

22. Enter values of **1000'** for the radius and **100'** for the transition length.

23. Now **create a centerline** by DP at the locations shown below.



24. Your result will be similar to the following



Note: But, we would like to utilize one of our *Feature Definitions* and our *Design Standards* for this centerline design.

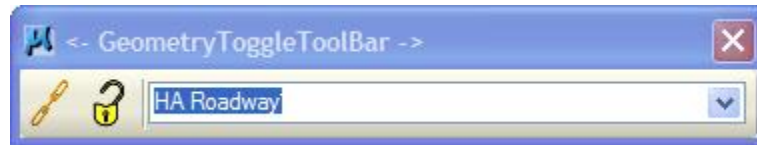
25. **Delete** this centerline with Microstation's delete command and we will do it over.

Note: Since these are Microstation elements *undo* and *redo* are completely supported.

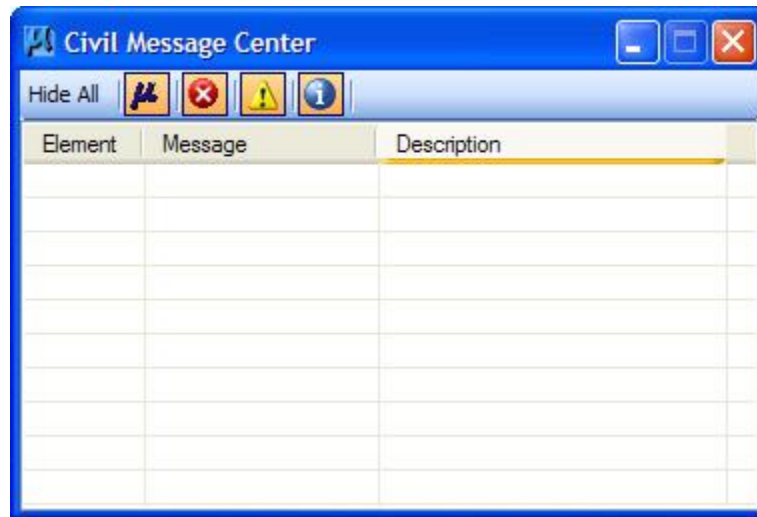
26. On the menu select **Tools > Civil Geometry > Design Standards** to open the design standards toggle bar.



27. On the menu select **Tools > Civil Geometry > Features Toggle Bar**

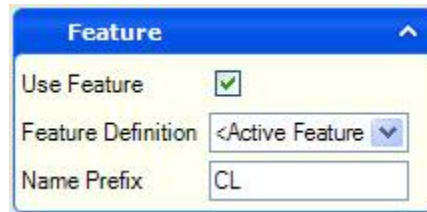


28. And for feedback on our tools we need the Civil Message Center. On menu select **Tools > Civil Geometry > Civil Message Center**.



29. Dock and pin the message center at bottom. Leave the design standards and feature definitions bars floating.
30. Restart the **Complex By PI** command.
31. On the design standard tool bar select the **4 lane\60 MPH** standard as shown above.
32. Click the toggle button to left of the design standard name. (It will be orange when toggled on)
33. Notice that the Complex By PI tool is now populated with new values. These values came from the design standard.
34. On the Features toggle bar choose the feature definition found at **RG.ddb > Drafting Standards > Horizontal Alignment > HA Roadway**. This sets the active feature definition.

35. Then on the Complex By PI dialog set the feature check mark and select “**active feature**”.



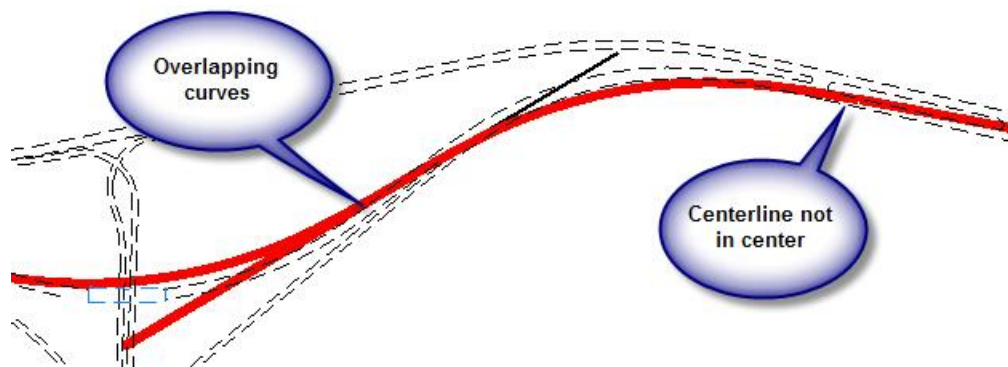
36. This sets the command to use the feature displayed in the feature definition toggle bar.

37. The name prefix comes from the feature definition.

Note: the name prefix functions like an auto numbering process. In this example, the first element would be named CL, the next would be CL1, CL2, and so on. But it can also be used for absolute naming which is especially useful for alignments. So, for example, I could have entered a name prefix here of “BOB RD” and since there is no other element with that name, the alignment would be named “BOB RD”. In other words, no suffix.

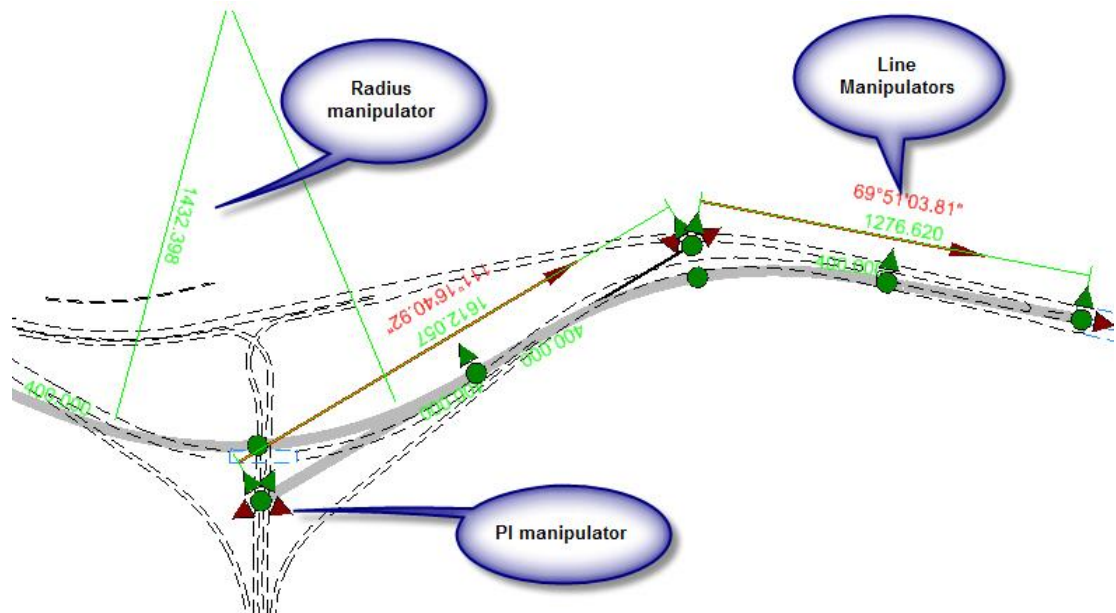
38. Now redo the centerline. The design standards will take care of curve radius and transition length while the feature definition takes care of symbology.

39. It is possible that on the 3rd tangent you will end up with overlapping curves. That’s OK. Good in fact. Because it gives us a learning opportunity.



40. We can correct these problems without redoing the centerline.

41. Select the centerline with Microstation Selection tool.

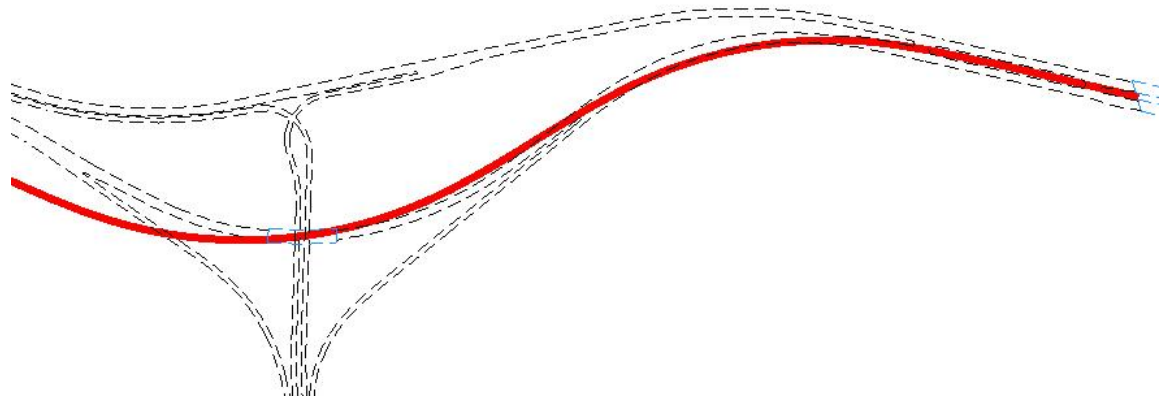


42. Note the manipulators that appear on screen. We can edit our centerline by editing the values in text manipulators or dragging the handles.

Note: These properties are also available for editing in the Element Info property panels.

43. Click the circular PI manipulator at the 2nd PI and drag it to a suitable location which also resolves the overlap in the curves.

44. Click the 3rd PI drag handle and move it until the last tangent lines up with the center of the existing pavement.



Lesson Name: Mainline Edges of Pavement

LESSON OBJECTIVE:

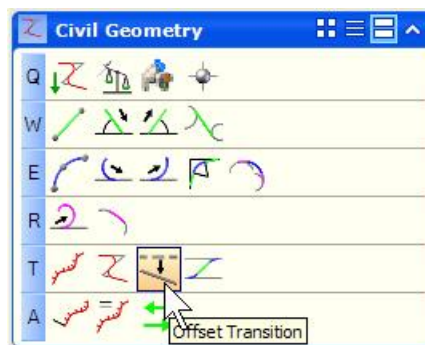
In this lesson we will utilize features to construct the edges of pavement for the mainline roadway.

EXERCISE: CONSTRUCT THE EDGES OF PAVEMENT

We will use the Offset Transition tool to construct the edges of pavement

45. Set the features toggle bar to use feature definition at **RG.ddb > Drafting Standards > Pavement Lines > SHLD Prop.**

46. Start the **Offset Transition** command

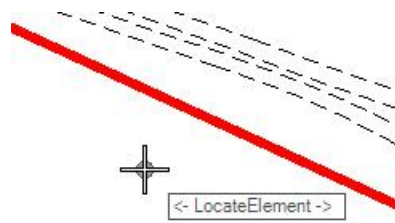


47. On the command dialog set the feature to active feature.

48. Turn on the check marks for beginning of element and ending of element

A screenshot of the 'Offset Transition' command dialog box. It has three main sections: 'Placement Method', 'Distance', and 'Feature'.
- 'Placement Method': 'Single Offset' is selected in the dropdown. The 'Offset' checkbox is unchecked, and the value '100.320' is in the adjacent field.
- 'Distance': 'Beginning Of Element' is checked. 'Start' is unchecked with a value of '0.000'. 'End Of Element' is checked. 'End' is unchecked with a value of '0.000'.
- 'Feature': 'Use Feature' is checked. 'Feature Definition' is set to '<Active Feature>'. 'Name Prefix' is set to 'SHLD Prop'.

49. Now following the on screen prompts. Locate element – select the centerline

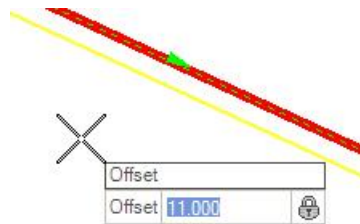


50. For placement method choose Single Offset.

51. Note: You can toggle thru the options by using up and down arrows on the keyboard to toggle between Single Offset, Variable Offset, and Offset and Ration methods.



52. Key in 11 and press Enter key to set and lock an 11.0' offset.

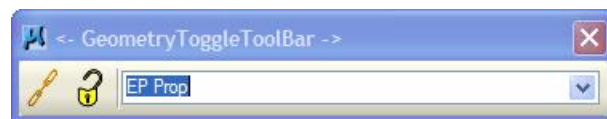


53. Now click on screen to accept the construction and create the offset element.

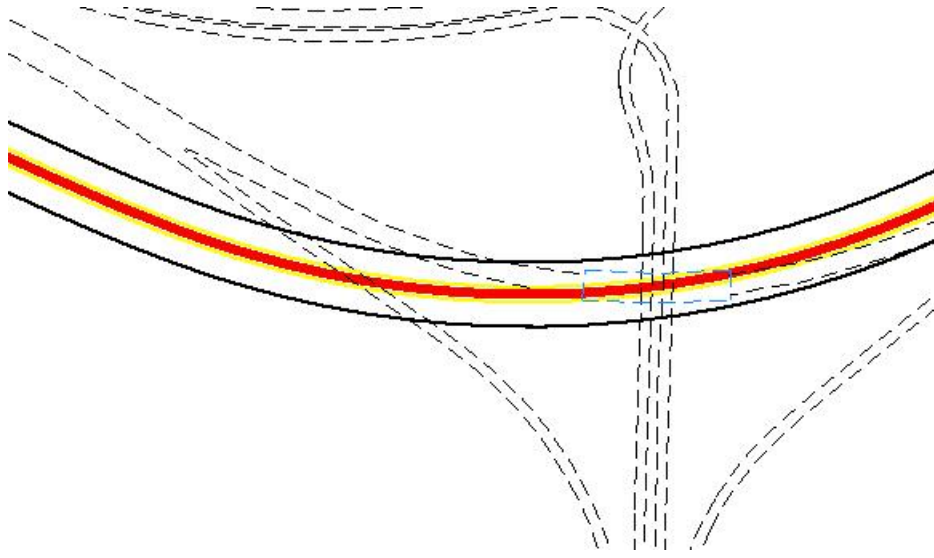
Note: we are constructing a multilane divided with center barrier which is why we need to set the inside shoulder.

54. Repeat for 11.0' offset on opposite side.

55. Change the active feature to **Drafting Standards > Pavement Lines > EP Prop**



56. Repeat the offset at **57'** each side of centerline.



Lesson Name: Mainline Edits and Manipulation

LESSON OBJECTIVE:

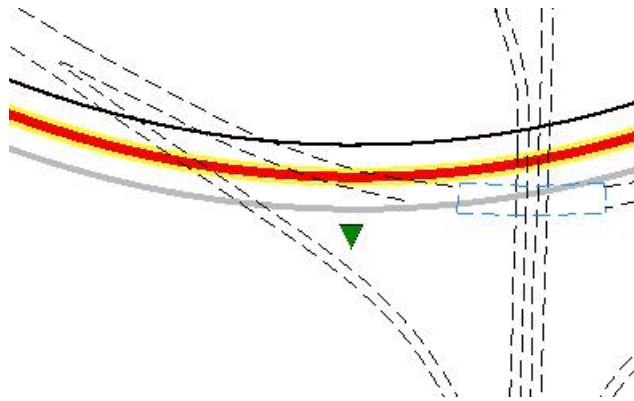
In this lesson we will review our alignment and utilize heads up manipulators to make adjustments to better fit the project.

EXERCISE: EDIT THE CENTERLINE

We looked at some centerline adjustments in the previous lesson. In this lesson we will look at a further centerline adjustment and correct an error in the pavement edge calculations.

57. There was an error when we created our outside edges of pavement. Our section is 3 lanes in each direction (36 feet) plus an 11 feet median each side of centerline. So the outside edge should have been set at 47 feet not 57.

58. Select one of the outside edges of pavement. Note the width drag handle at the midpoint.

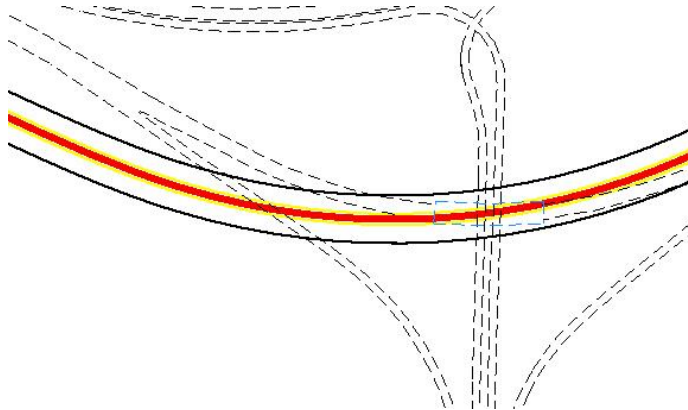


59. We could drag this to set the width dynamically. But a more precise entry is needed.

60. Zoom in until you also see a text manipulator for the width. Click on the text to allow changing of the value. Change the offset to 47 feet

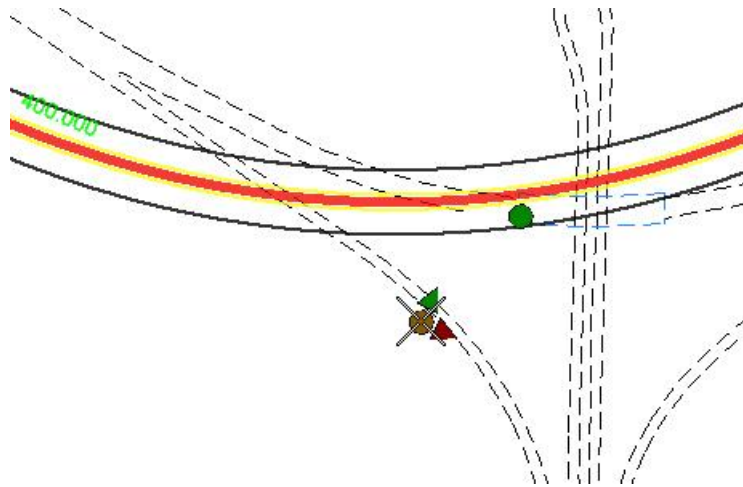


61. Repeat on left side with a value of -47 feet.
62. Zoom to the area where centerline crosses the cross road.



Note: We see that the centerline and proposed pavements lay directly atop an existing overpass. Since it will be necessary to maintain traffic across this existing bridge, we need to adjust our centerline so that we can construct at least half the new bridge while maintaining traffic on the old bridge.

63. Select the centerline and adjust the alignment so that at least half the new bridge is off the old bridge.



64. Notice that the edit is dynamic and because of the relationship of the pavement to the centerline, the edges get updated as well.

Lesson Name: Cross-road Alignment and Pavement Edges

LESSON OBJECTIVE:

In this lesson we will utilize design standards and feature table to construct the cross-road alignment and pavement edges.

EXERCISE: CREATE CROSS-ROAD

Instead of an alignment tool as we used on mainline above, we will build the cross-street by components and then join them into an alignment.

65. We will use Civil Accudraw to help us place the alignment tangents precisely. Open the Civil Accudraw toolbox at Tools > Civil Accudraw > Activate Toolbar.



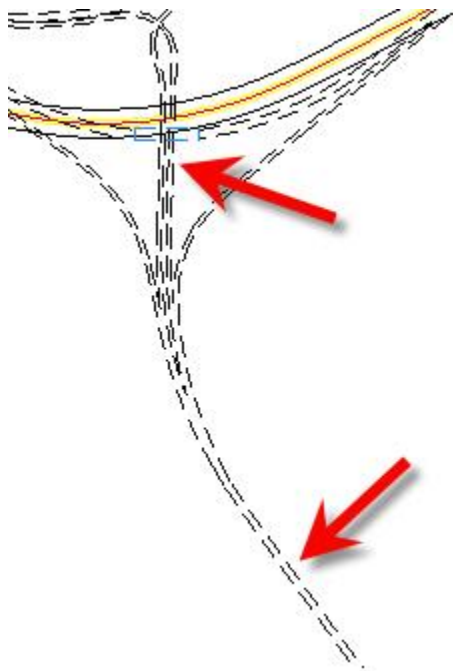
66. Toggle on Civil Accudraw by click the first icon and switch to station-offset mode by clicking the last icon as shown above.

67. Set the Design Standard to 2 Lane\50 MPH

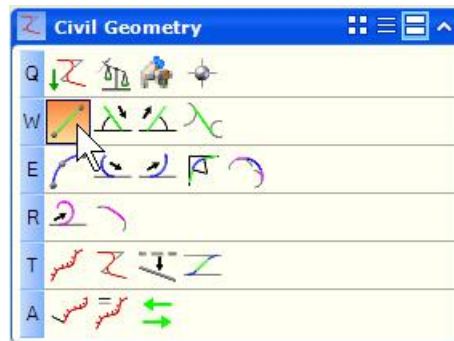
68. Set the Feature Definition to "No Feature"

Note: when no feature is used the elements revert to active Microstation symbology

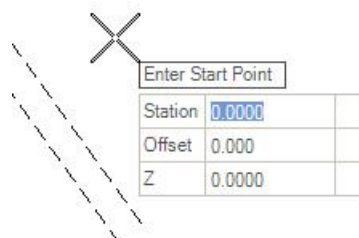
69. We will use the Line Between Points command to create the two tangents.



70. Zoom in on the southernmost tangent and Start Line Between Points command.



71. With Line Between Points running along with Civil Accudraw station/offset ordinates we get the following prompt.

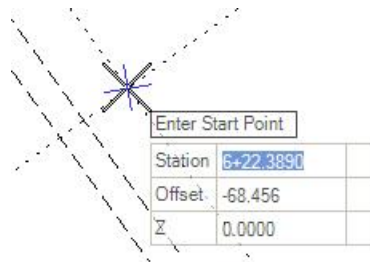


72. Station and offset show zero because we have not yet set the alignment from which station and offset will be computed.

73. With focus in either station or offset fields click O (the letter O for origin) on the keyboard.

74. Then pick one of the edges of pavement.

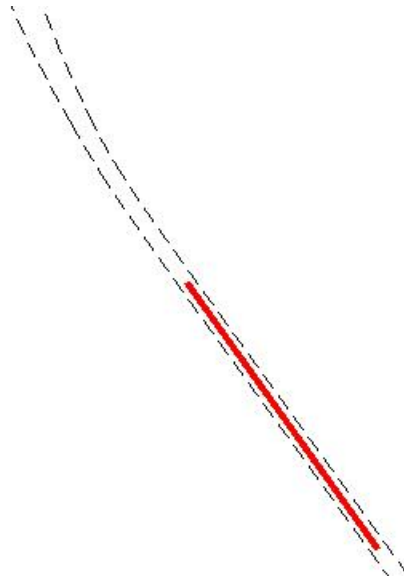
75. Now our station and offset are tracking along the edges of pavement.



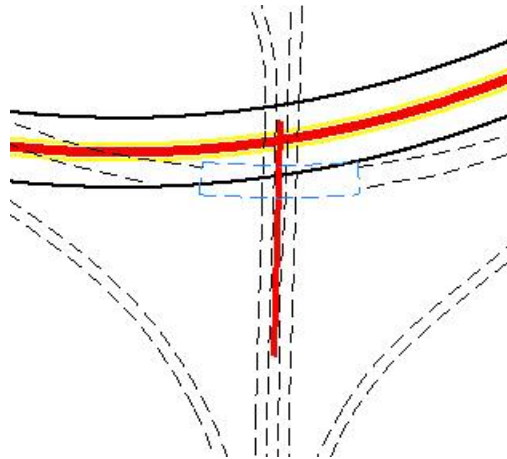
76. We know our existing pavement is 24 feet wide at this location so we can lock the offset at 12 to set our line in center of the pavement.

77. Tab to the Offset field and type 12 and click enter key.

78. Using the locked 12 foot offset DP to set the two ends of the line in the straight portion of the pavement.

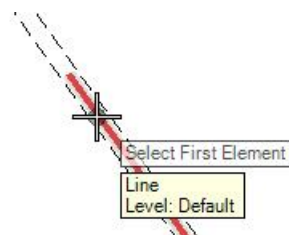


79. Now repeat this exercise to create the centerline tangent for the northern section. There is a median on this tangent which is 14 feet wide, so if you use the median edge for station/offset then your offset value will be 7.

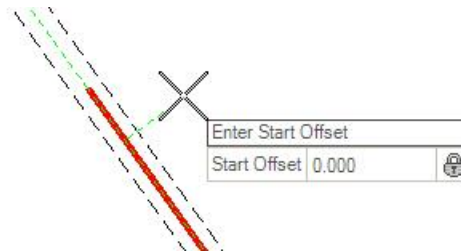


80. Now use the Arc Between Elements command to construct an SCS curve between these two tangents. (Remember: we have design standards set to 50MPH which should guide our construction)

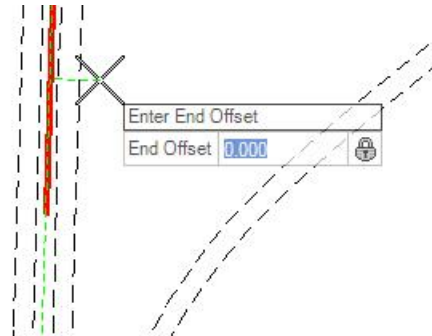
81. Pick first element (southern tangent)



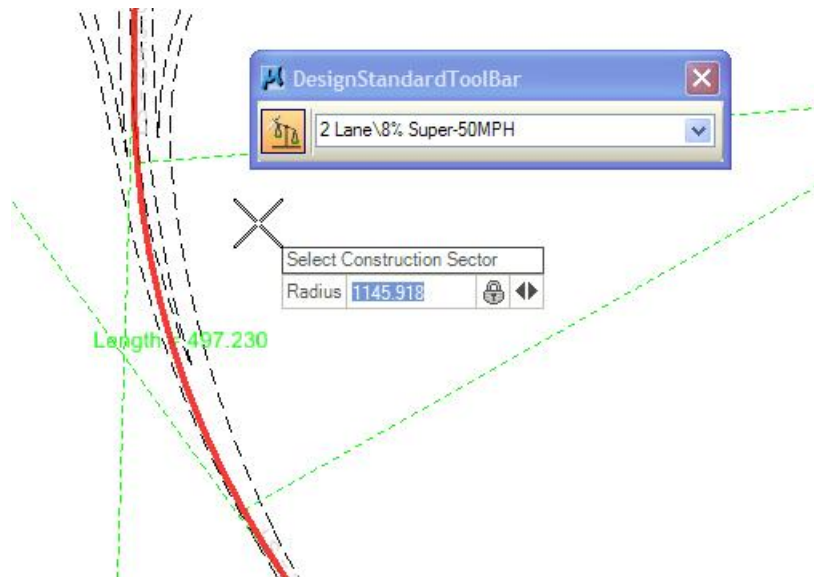
82. Offset = 0



83. Pick second element (northern tangent) and use offset =0



84. The design standards sets default radius to 1145 (5 degree curve) with corresponding transition lengths.

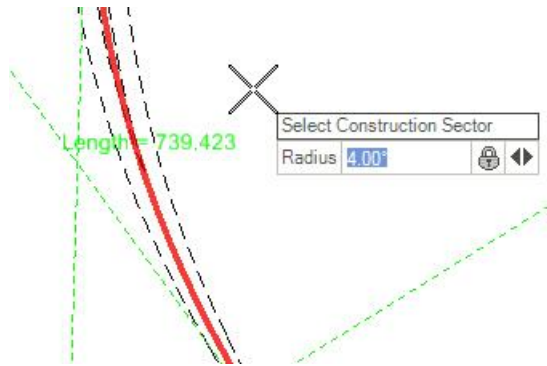


Note: But this radius does not match the existing road very well.

85. Let's try a 4 degree curve and see if it fits better. To enter degree of curve into any arc command, use the degree of curve toggle (the letter d by default)

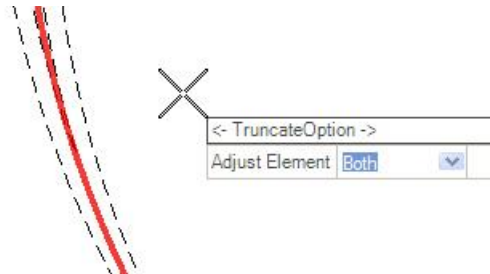


86. Now our curve fits a lot better and still satisfies design standards.



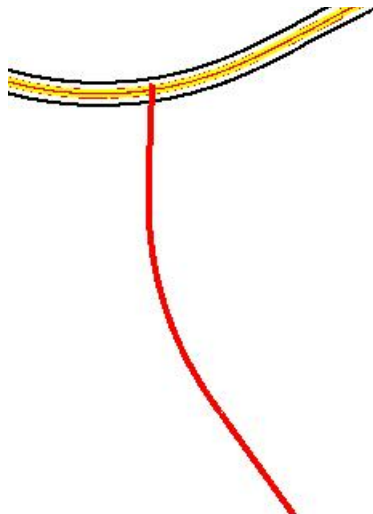
87. Use right or left arrow keys to view the transitions lengths. The design standards have updated these to 200 feet to match the updated radius (degree of curve).

88. Then set and accept the truncate option to BOTH to trim the tangents to match the completed curve. (use up-down arrows to switch between choices in a drop down list like this)



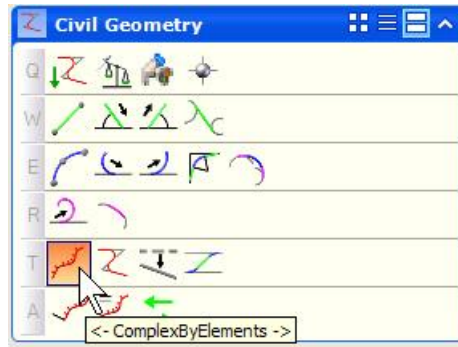
89. We no longer need the reference file display so for clarity, turn off its display.

90. Now we have two lines and a curve that will make up our cross-road alignment.

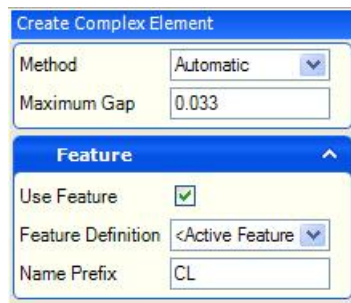


91. On the Features toggle bar choose the feature definition found at RG.ddb > Drafting Standards > Horizontal Alignment > HA Roadway.

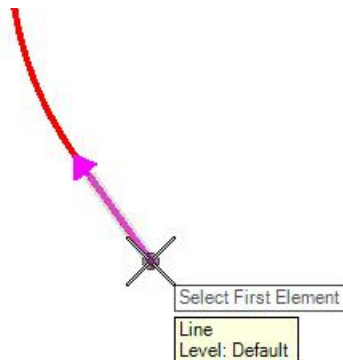
92. Start the complex by Elements command to create a complex element of these components. (IE create an alignment)



93. Set the method to automatic and feature to active feature.

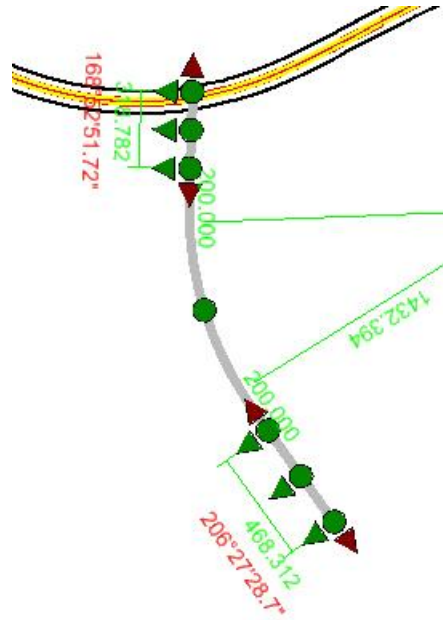


94. Now pick the southern tangent (our alignment will run north to south)

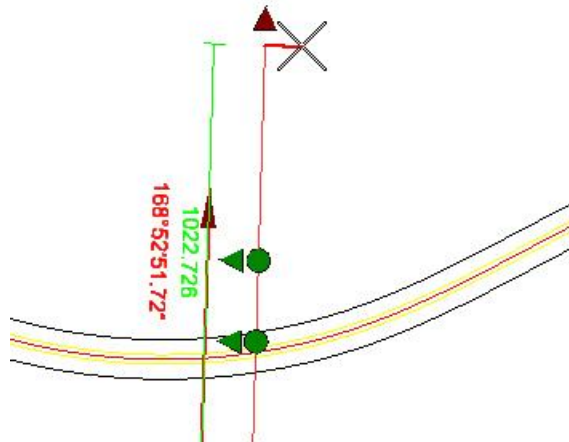


95. Notice direction arrow.

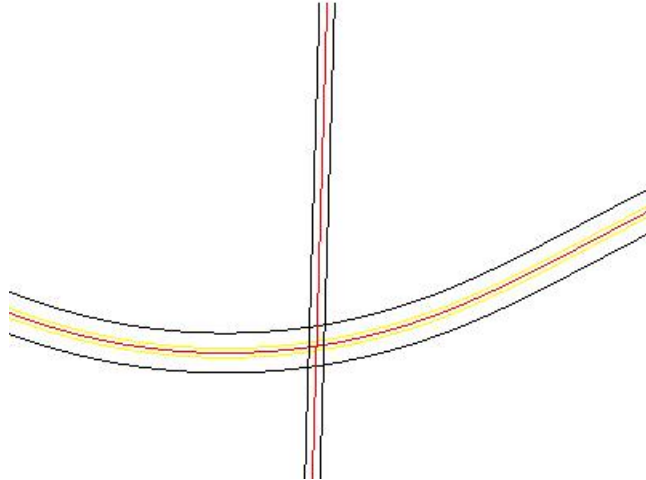
96. With automatic mode the connecting elements will be detected and combined into a complex.



97. We probably need more working room to the north of the mainline to construct our ramps so drag the end trim/extend manipulator until the last line segment is about 1100 feet long.



98. Finally, using the Offset Transition tool we used on the mainline, create edges of pavement for the cross-road. We want a 3 lane section so use 18 feet each side of centerline for the full extents of the alignment. Use feature “EP Prop”.



Lesson Name: South East Ramp (Ramp Number 1)

LESSON OBJECTIVE:

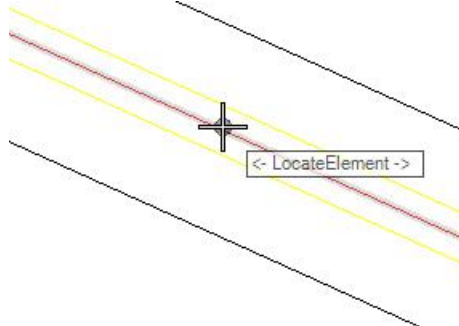
In this lesson we will construct the south east ramp, its edges of pavement and gore area.

EXERCISE: CONSTRUCT THE SOUTH EAST RAMP

We will construct the southeast ramp baseline which runs along the ramp outside edge of pavement, then construct the opposite edge of pavement then the gore area and intersection with the cross-road.

99. We will be constructing the alignment using components like we did for the cross road, so set the Active Feature definition to “No Feature”

100. Start the Offset Transition tool to construct the ramp departure. Choose the mainline centerline as base element.

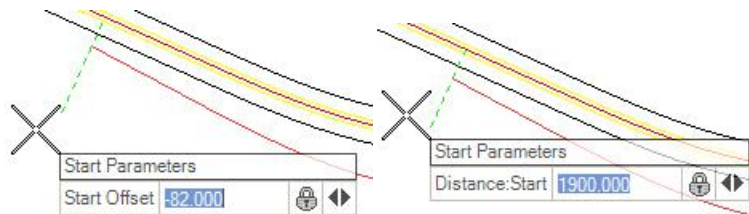


101. The next prompt is for method. Choose Offset and ratio.



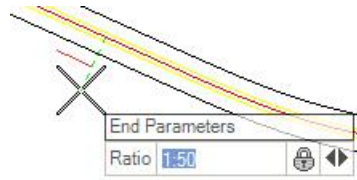
102. The next prompt is for station and offset of the beginning of the offset. We need 82 feet for the offset. (11' shld + 36' lanes + 10' gore recovery area + 6' gore + 19' ramp entrance). We can use 19+00 for distance (station) as a nice round number.

REMEMBER: The arrows to the right of the prompt indicate that you can enter two bits of information on this single prompt.

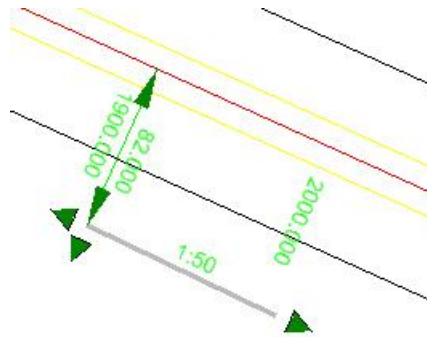


103. For the end enter a ratio of 50:1. The end distance is not terribly important. We simply need a short line segment to start the ramp. But try not to go past 20+00 so our element will end up as a simple line and not a complex.

NOTE: I know. Departure ramps use a 15:1 ratio. This is a purposeful error to provide a training opportunity later.

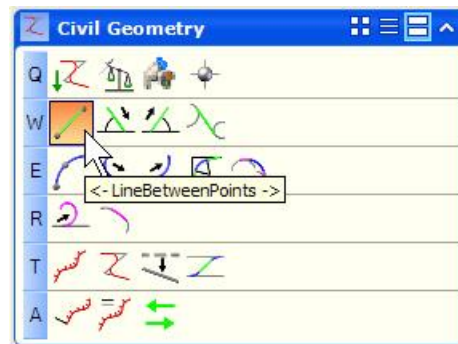


104. Now select the element you just created and note that we have a line with a fixed start point and offset and a ratio to define the line.

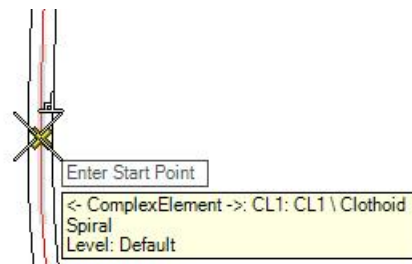


105. Now let's construct the opposite end of the baseline. At the intersection we need a simple line, perpendicular to the cross road alignment at some convenient location.

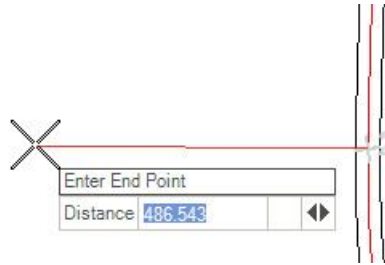
106. Start Line Between Points Command.



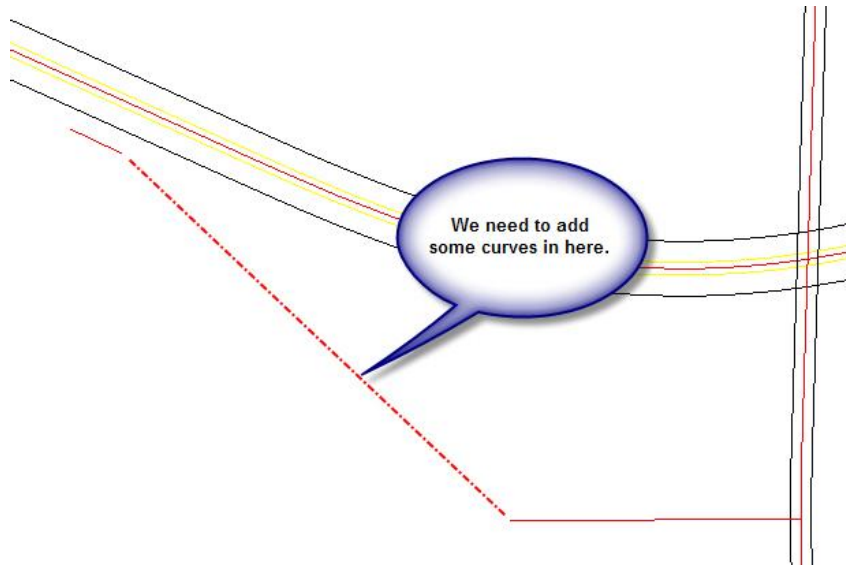
107. Set Microstation's snap mode to perpendicular and make sure AccuSnap is on. Set the first point of the line perpendicular to the cross-road



108. Set the end point about 400' or 500' away from the cross-road.

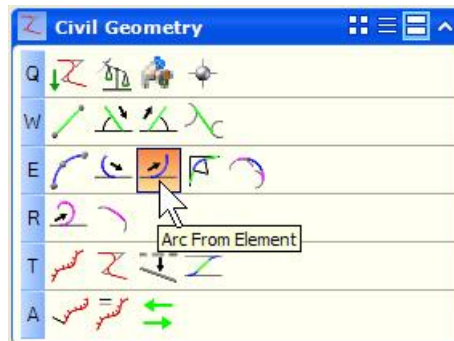


109.This establishes the end tangent of the ramp baseline.



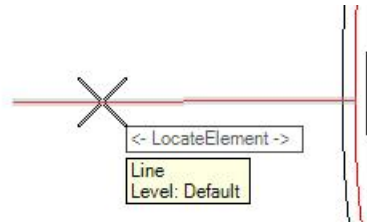
110.Now we need to fill in the middle.

111.Let's use the Arc From Element command to construct a curve from end tangent.

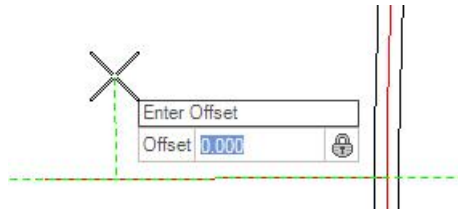


112.This is a curve coming up to a stop condition so a design standard is probably not necessary but you can try using one if you wish.

113. Pick the tangent line. We will construct the curve using this as a base element.



114. Offset will be zero

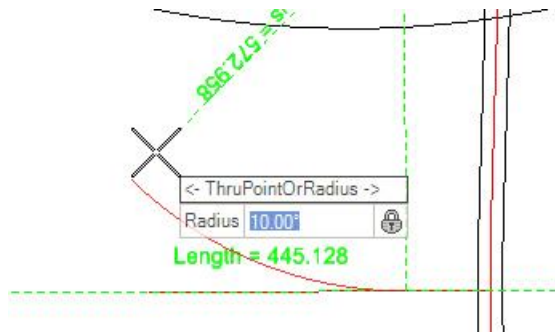


115. Set the start point (this will be the point of tangency for the curve) close to (but not too close) the cross-road alignment

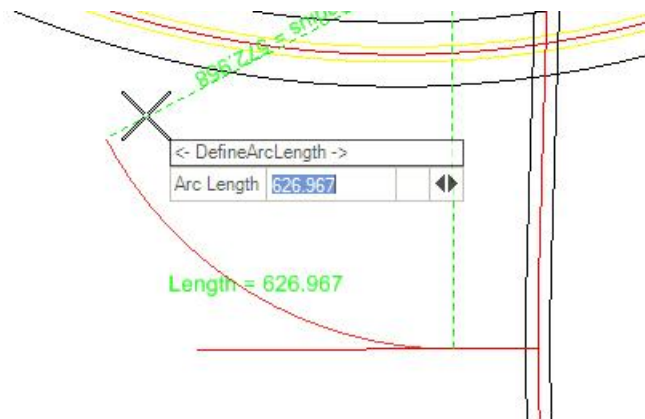


116. Since we are not using a design standard the radius is not populated for us. Let's try a 10 degree curve.

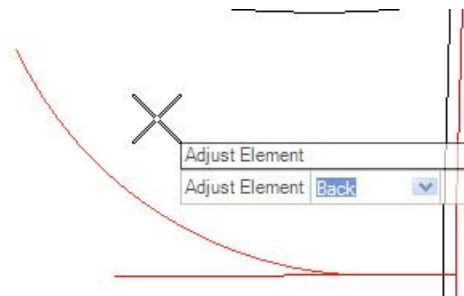
REMEMBER: Use d10 to enter a degree of curve instead of a radius.



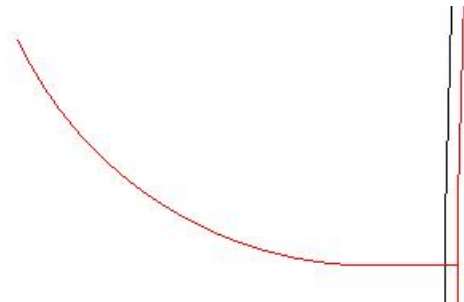
117. Arc length is not important. Make it plenty long. It will get trimmed with subsequent commands.



118. Then trim the base element.



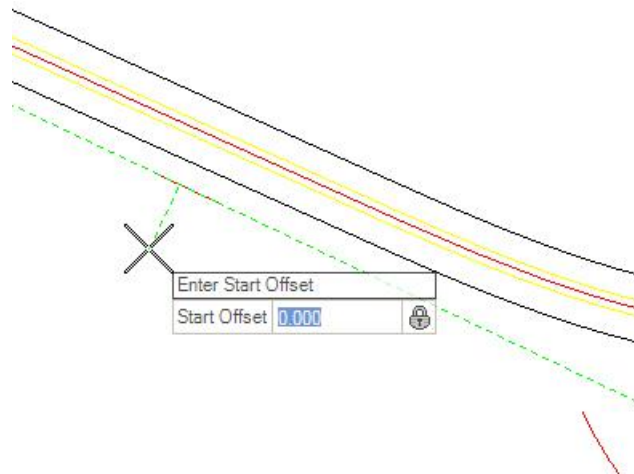
119. Now we have a curve coming up to the intersection.



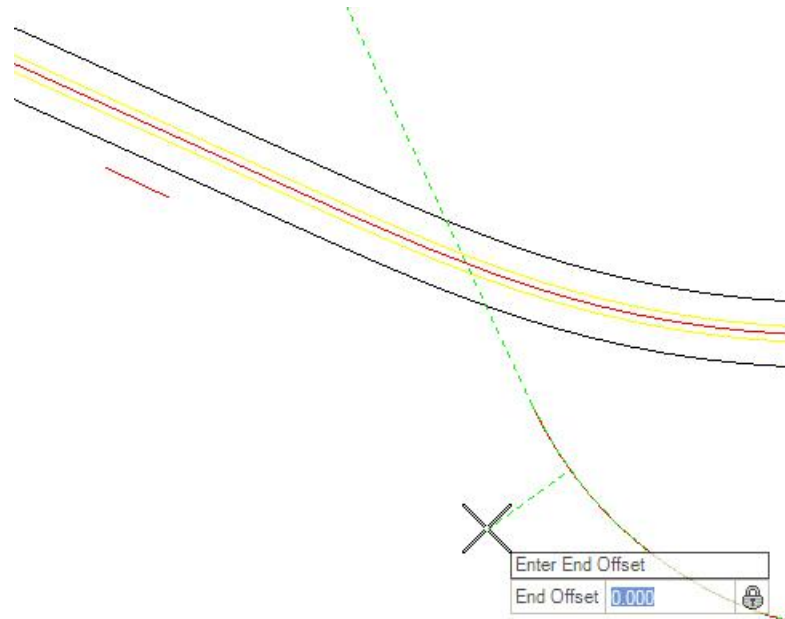
120. Now we have a curve coming up to the intersection.

121. We will use Arc Between Elements to finish the ramp baseline components.

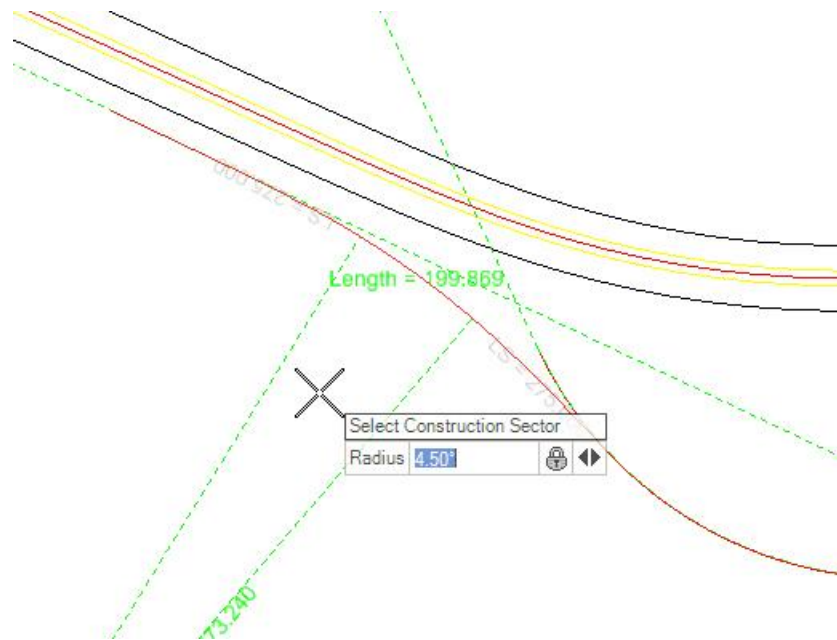
122. For the back element pick the short line at ramp departure using 0.00' for offset



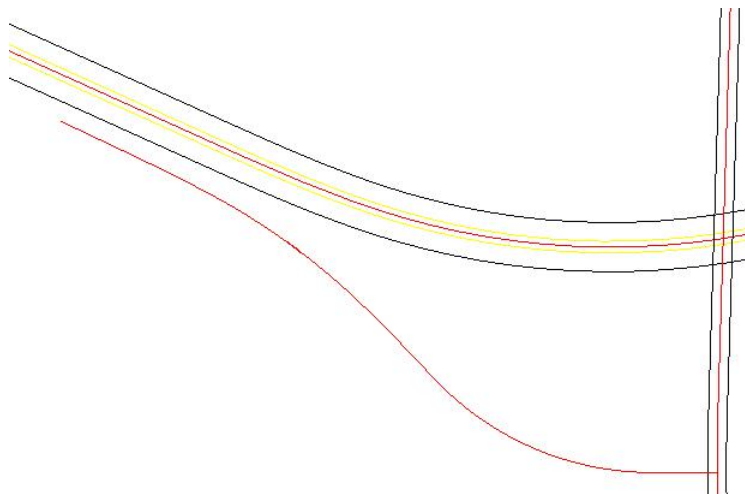
123. Pick the intersection arc for ahead element and 0.00' offset



124.If you use a 50MPH design standard, then a 5 degree curve will be selected automatically. We will use a 4^30' curve with 275' transitions.



125.This completes the components of our ramp baseline.



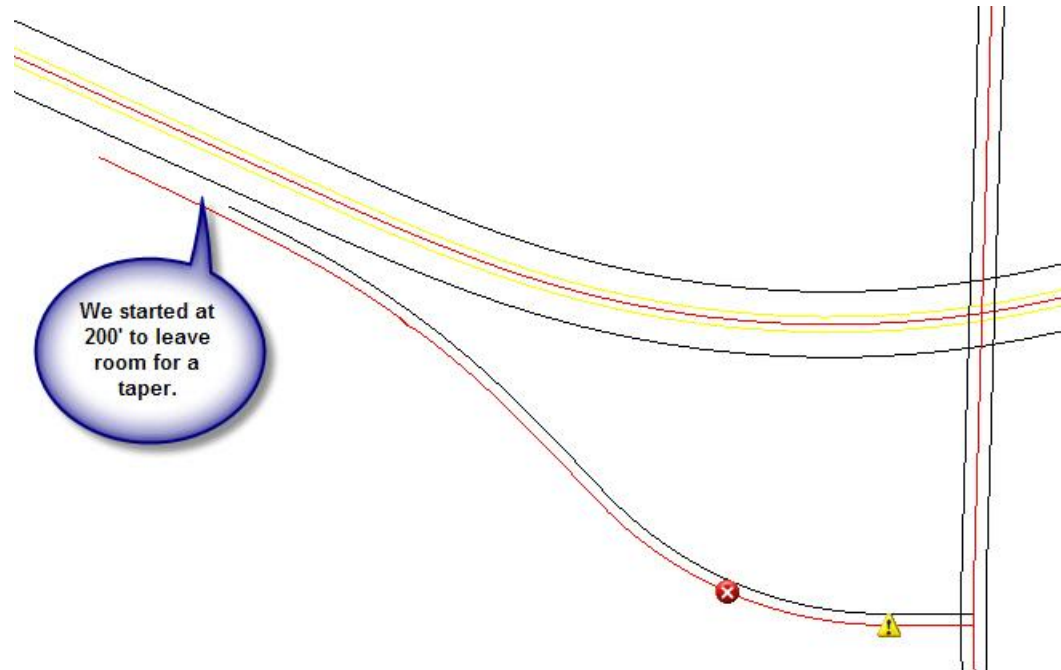
126.Now we can create the ramp edge of pavement for opposite side.

127.Set active feature to HA Roadway.

128.Use the Complex By Elements command to join the components into a complex.

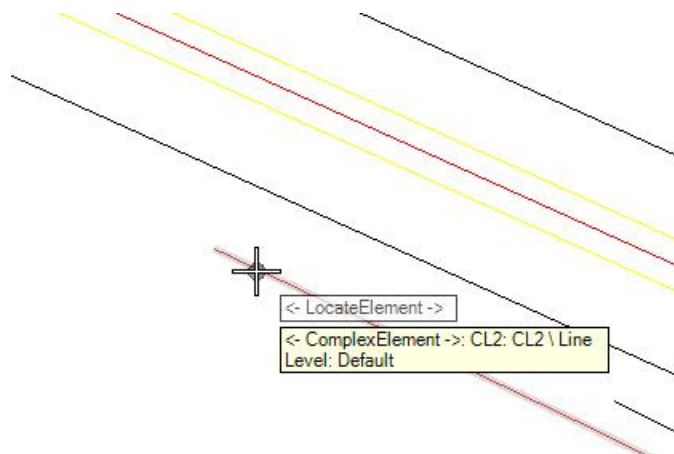
EXERCISE: CONSTRUCT RAMP EDGE OF PAVEMENT

129. Use the Offset Transition tool with single offset method. Offset equal to 16'. Begin at distance 200' and continue all the way to intersection.

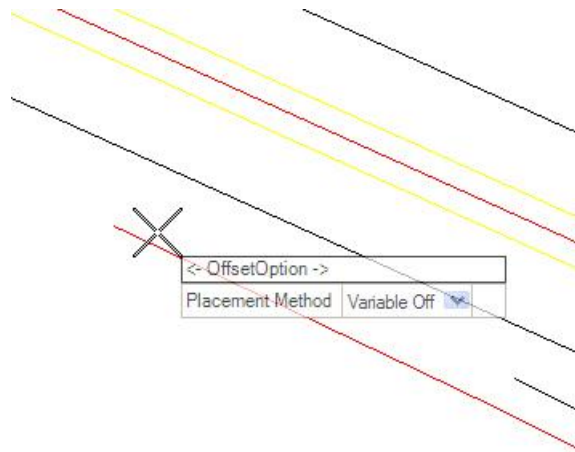


NOTE: The error glyphs on the screen are a result of design standards. If you had the 50 MPH design standard active when you created the complex then you will see this errors. Remember, we used a 10 degree curve for the curve at the intersection which exceed the 50MPH standard. We can ignore this error message since we know that the curve is OK.

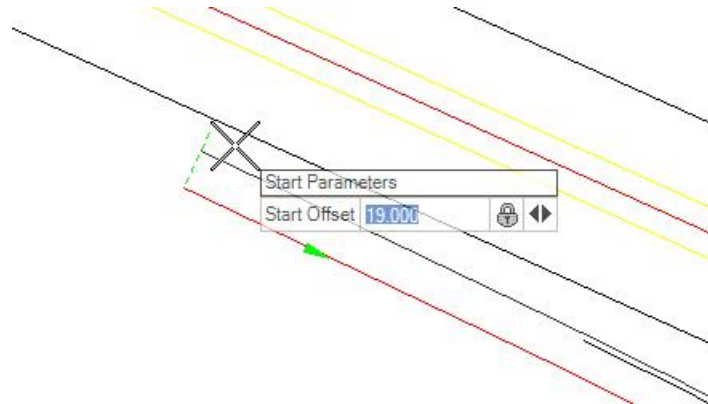
130. We can fill the 200' gap at beginning of ramp with offset transition tool using variable offset method. Pick ramp baseline as base element.



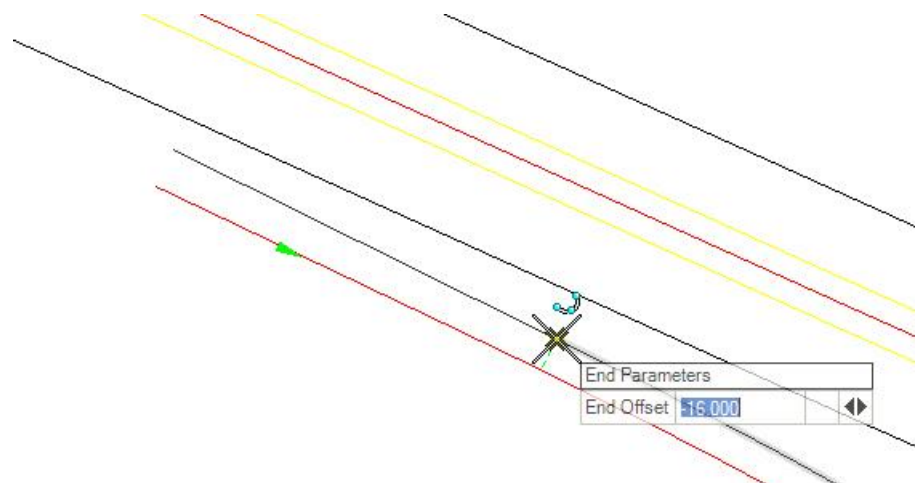
131.Method will be Variable Offset



132.Beginning offset is 19' at beginning of ramp.



133.For end, snap to the 16' offset we did above.

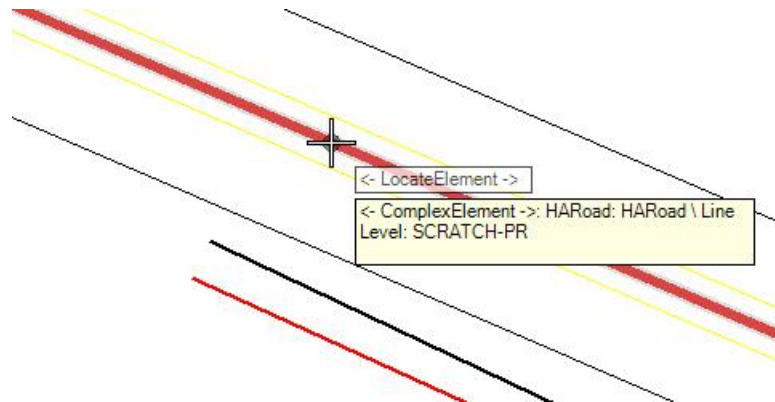


EXERCISE: CONSTRUCT THE SOUTH EAST RAMP GORE AREA

We will construct the gore area using mainly the offset transition tool.

134. First use the offset transition tool to build the recovery area. Use Offset/Ratio method with a 36:1 ratio.

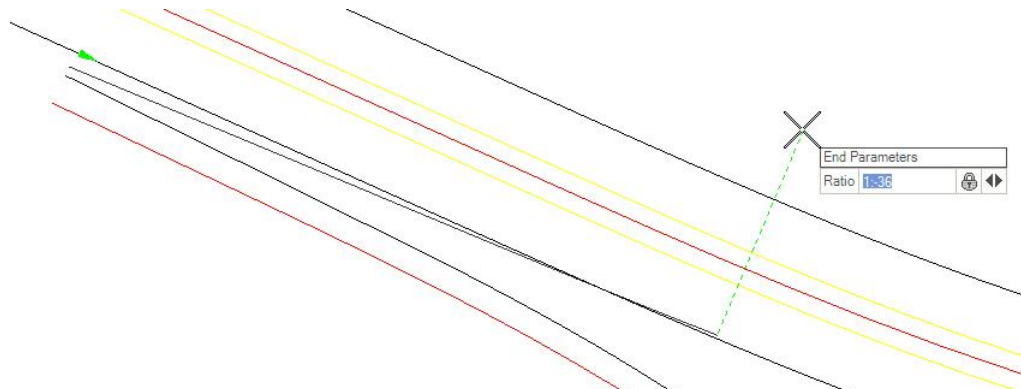
135. Use mainline as base element.



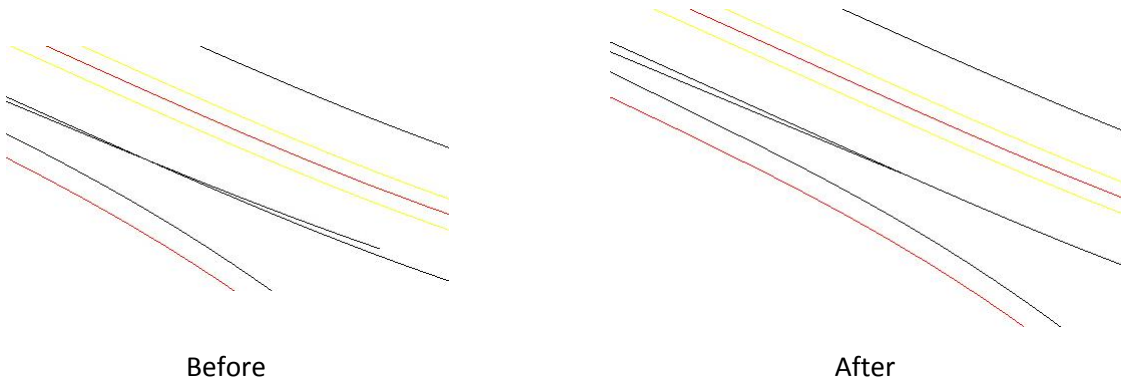
136. Lock 57' offset and snap to beginning of ramp baseline to set start point.



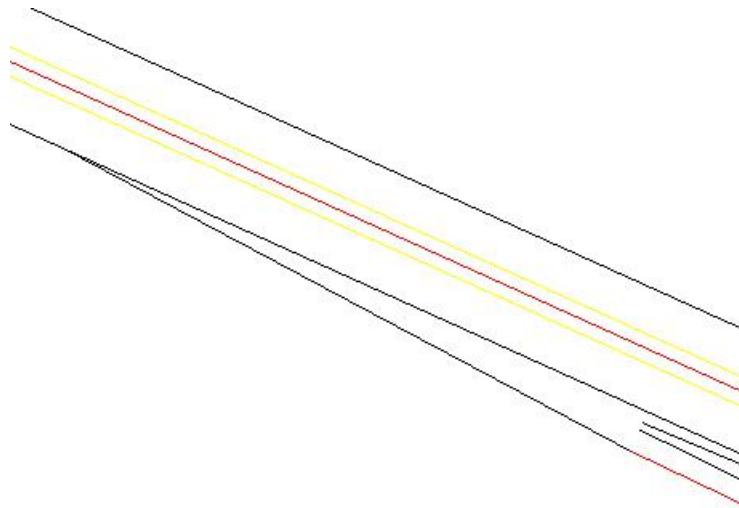
137. Use -36:1 ratio and extend beyond where the line crosses mainline edge of pavement.



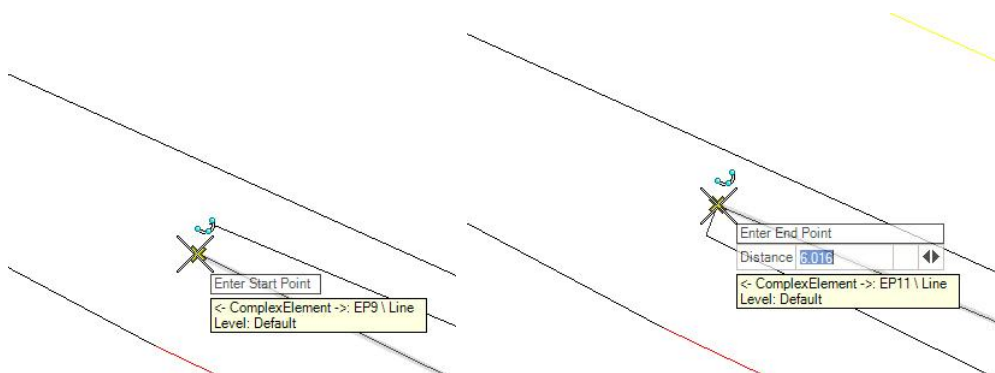
138. In the last step above we extended the line beyond where it crosses the mainline edge of pavement, we did this purely for convenience. Now we will use the Microstation Trim to Element tool to clean up this line.



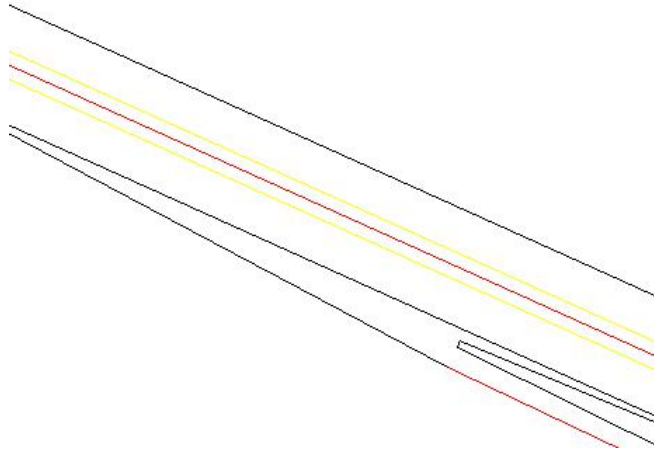
139. Repeat steps 158-161 to create the ramp taper using 15:1 ratio.



140. Finally, use the Line Between Points command to close the gore area by snapping to end points.



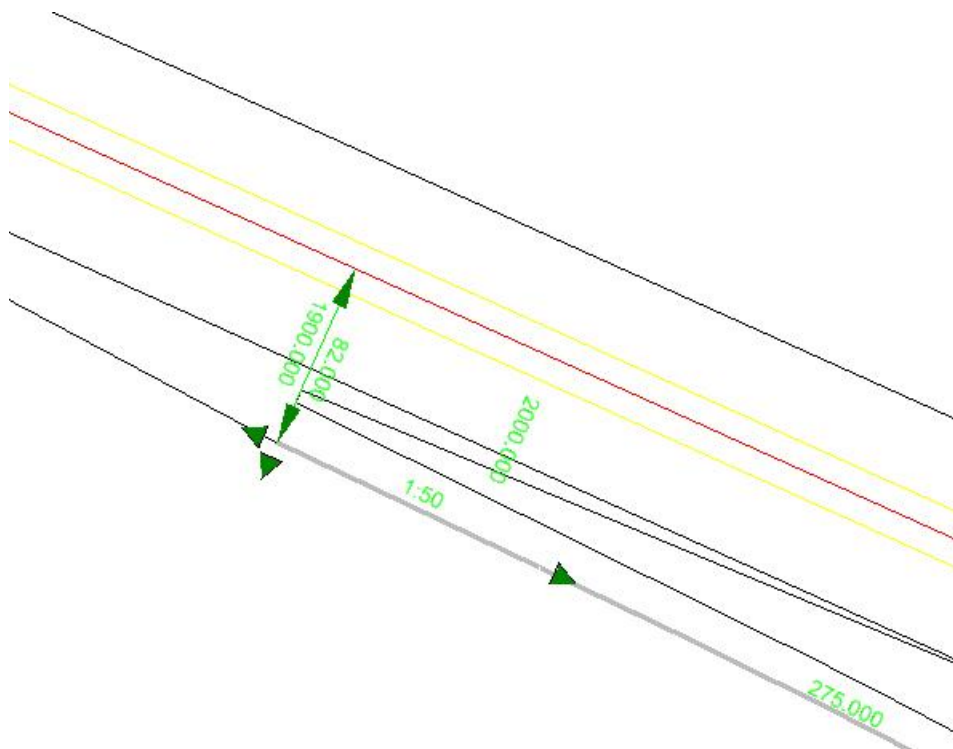
141.Finished Gore area.



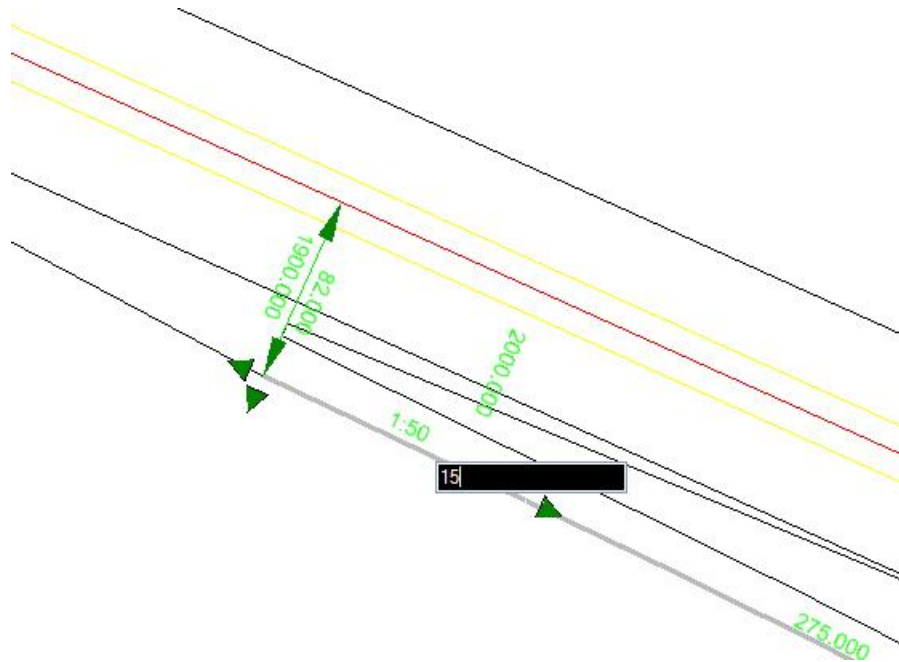
Note: Do you notice the kink where the ramp taper meets the ramp baseline? This is because of the error we introduced way back in step 104.

We purposely introduced an error there so we can demonstrate the power of the edit manipulators. We do not have to perform a bunch of recalculations to correct this error.

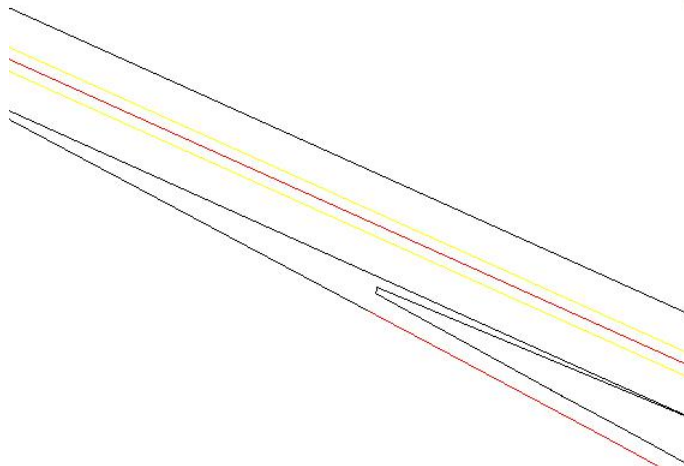
142.Select the ramp baseline and zoom in to the first tangent segment.



143. Now click on the 50:1 text manipulator (which we created in error) and change it to 15:1

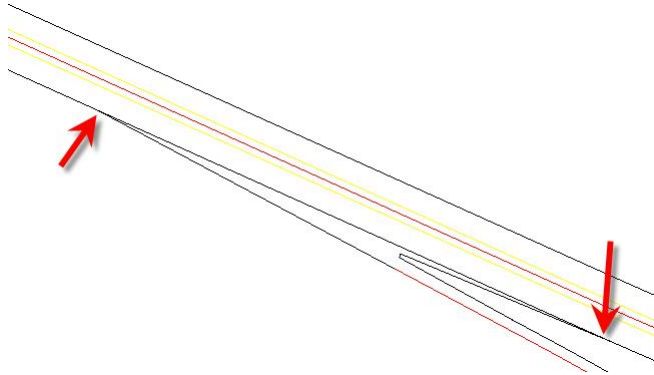


144. All the related calculations update.

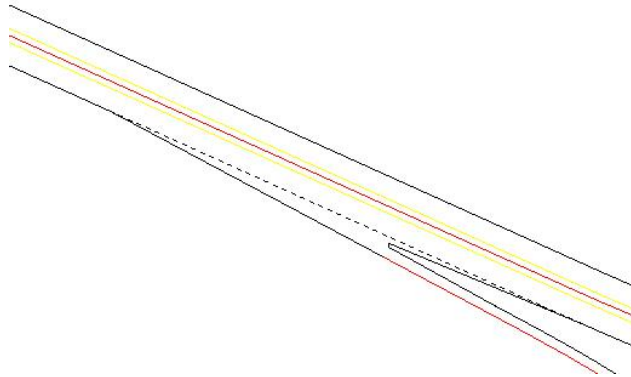


145. The portion of the mainline edge of pavement in the gore area is often shown as a dashed or dotted pavement striping. We can do this without disrupting the intelligence of the overall edge of pavement.

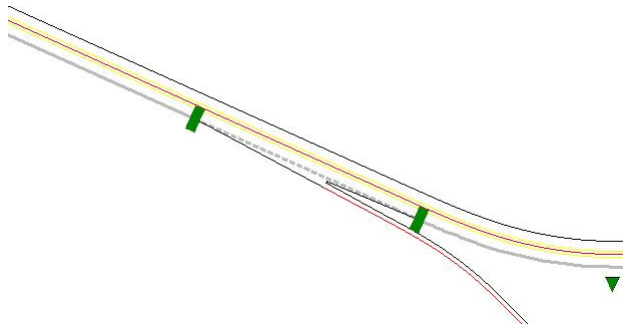
146. Use the Microstation Break command to break the edge of pavement where the ramp taper diverges and also where the recovery area joins the edge of pavement.



147. Now use the Microstation Change Element Attributes command to change the edge of pavement in the gore to line style 2.



148. Now select the edge of pavement to note that the overall edge is still intact.



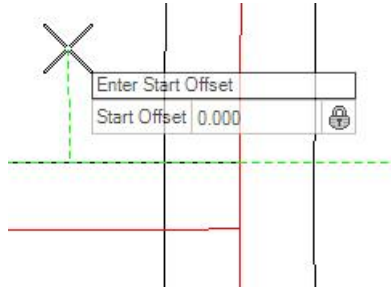
Note: Notice however that we have some new manipulators marking where I broke the pavement. The position of the break can be repositioned by dragging these manipulators.

EXERCISE: CONSTRUCT THE SOUTH EAST RAMP INTERSECTION CURB RETURNS

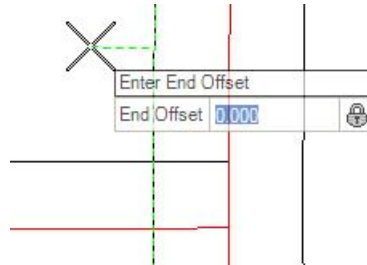
We will construct the curb returns at the intersection with cross road using the Arc Between Elements tool.

149.Set Active Feature to EP Prop

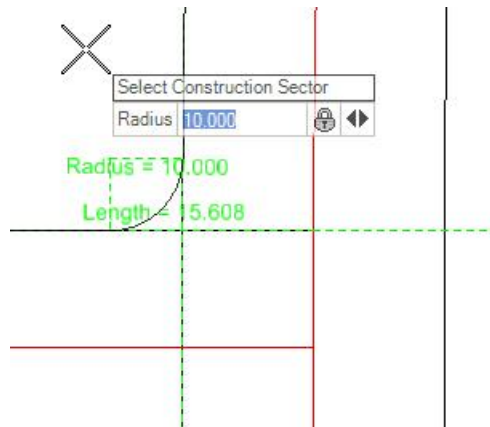
150.Start Arc Between Elements. Pick the ramp edge of pavement and 0.0 offset.



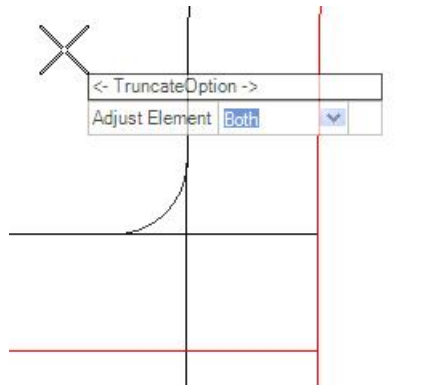
151.Pick the cross-road edge with 0.0 offset.



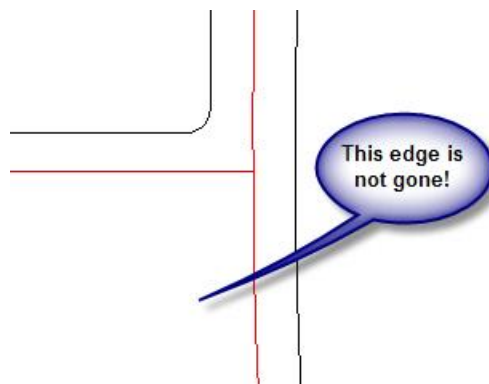
152. Use 10' radius.



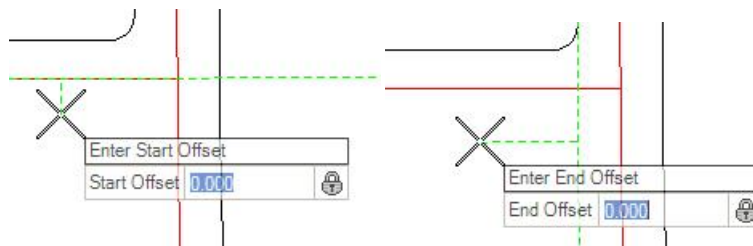
153. Trim Both



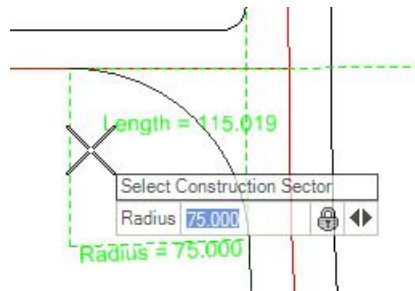
154. It will look like you have lost part of your pavement. Don't worry, you haven't. This will heal itself when we do the other curb return.



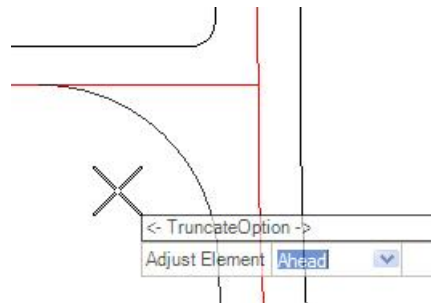
155. Use Arc Between Elements again for the other curb return.



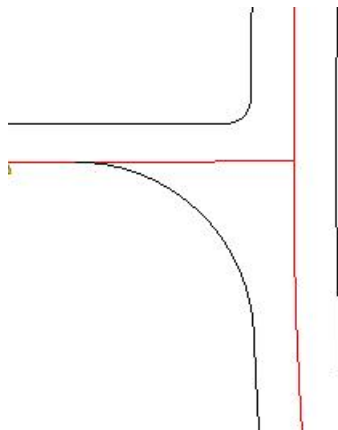
156. Use 75' for radius here for right turning truck traffic.



157. It is very important to trim only the edge of pavement for the cross road since the ramp edge is also our centerline.



158. The finished intersection.



Lesson Name: North East Ramp (Ramp Number 2)

LESSON OBJECTIVE:

In this lesson we will construct the North East Ramp. The construction will be substantially the same as the South East ramp above.

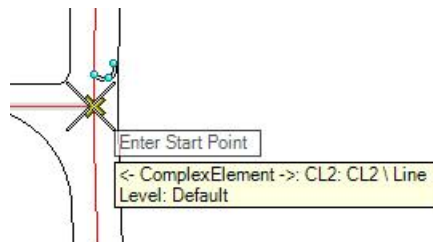
EXERCISE: CREATE THE NORTH EAST RAMP CENTERLINE

159. At the intersection with cross-road we need to start at the same point as the SE ramp and perpendicular to the cross-road. We can use Civil Accudraw to assist.

160. Make sure Civil Accudraw is toggled on and set to distance-direction method.

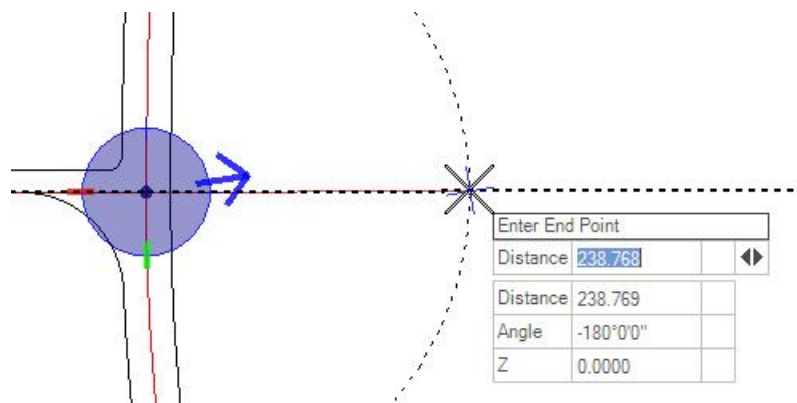
161. Set active feature to "No Feature".

162. Start Line By Points Command and for first point snap to end of the SE Ramp centerline.



163. Now using Civil Accudraw, place focus in one of the Accudraw fields and use the RQ (Rotate Quick) keyboard shortcut to rotate the compass in line with the SE Ramp centerline.

Note: RE (Rotate to Element) shortcut would work as well.



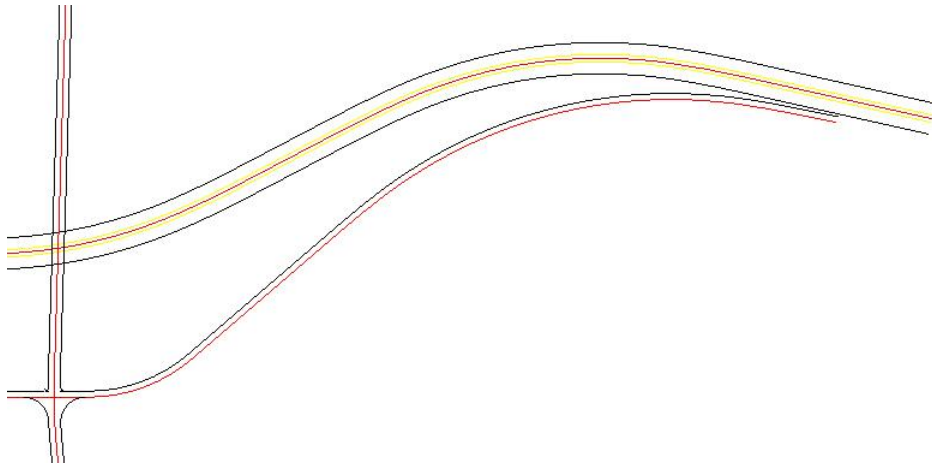
164. Once the compass is rotated then we can easily use the axis lock to insure we are perpendicular to the cross-road.

165. Create the line about 200' in length.

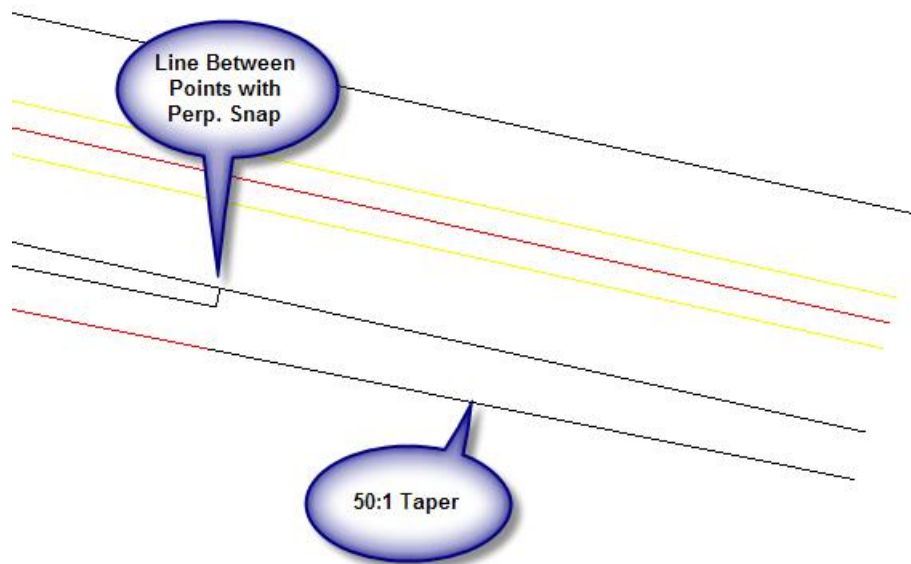
166. The remainder of ramp centerline construction will be similar to what we did on the SE Ramp. Key differences are:

- 50:1 ratio at the ratio to mainline
- Offset from mainline is 73'

167. Complete the centerline and ramp edges of pavement on your own or follow the instructor. There are some differences in the gore area, since this is an entrance ramp, which are shown below.



168. The entrance gore area is much simpler. We need to use Line Between Points to snap to the end of the ramp edge of pavement and then a perpendicular snap to mainline edge of pavement.



169. Then a 50:1 taper for the entrance onto the mainline.

Note: Our alignment is a little short to complete the ramp taper.

Lesson Name: Inside Loop Ramp (Ramp Number 3)

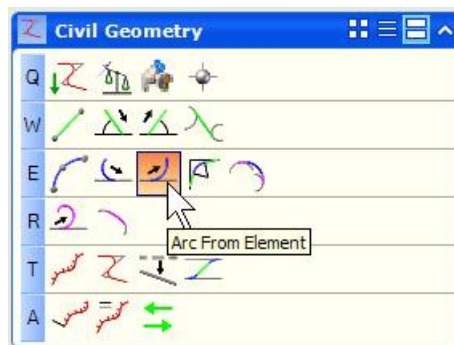
LESSON OBJECTIVE:

In this lesson we will construct the inside loop ramp and its edges of pavement.

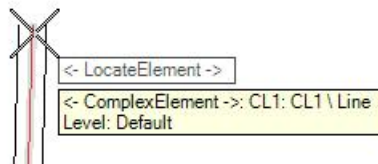
EXERCISE: CONSTRUCT RAMP CENTERLINE

Construct the inside ramp centerline. The loop ramps have some severe constraints that will reduce the designed speed of the ramps.

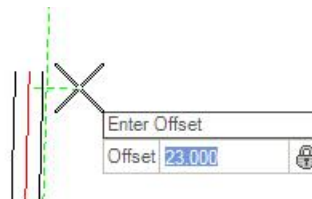
170. We will start by beginning the loop from the cross-road using the Arc From Element command.



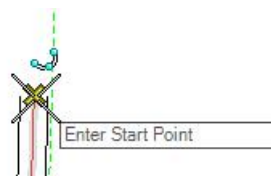
171. Choose the cross-road alignment as base element



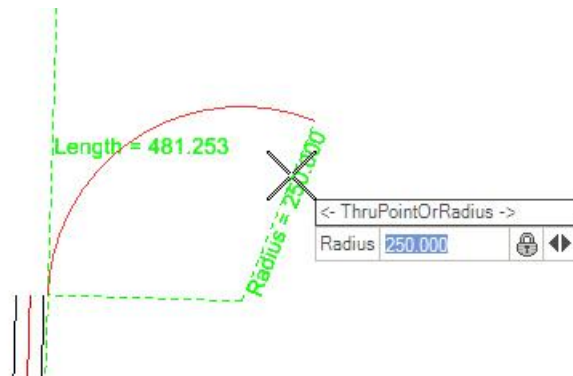
172. Offset needs to be 23' (ramp baseline follows outside edge so we must account for 7' median plus 16' ramp width = 23')



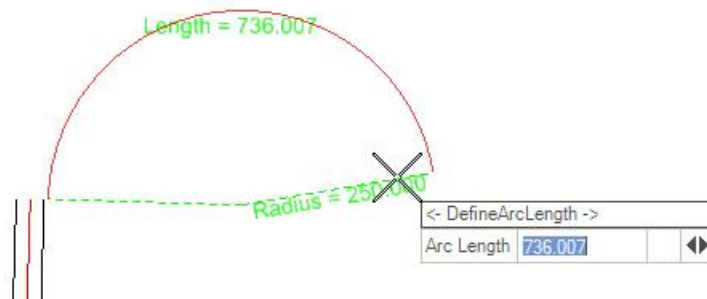
173. Start point for this arc will be opposite the end of the cross-road. Snap to the end of the cross-road alignment.



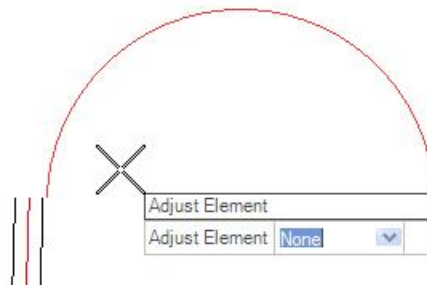
174. We will use a radius of 250' (This corresponds to a 30MPH design which is not desirable but necessary)



175. Set arc length.

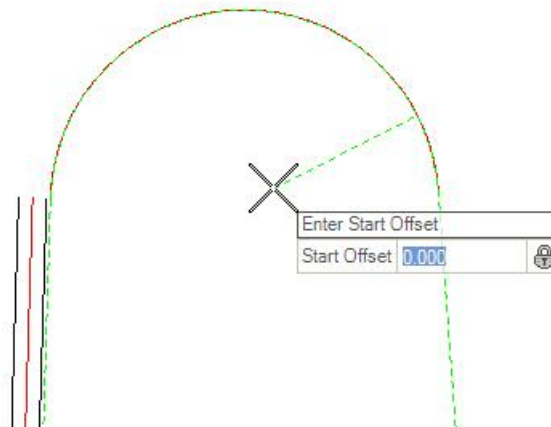


176. No truncation of base elements.

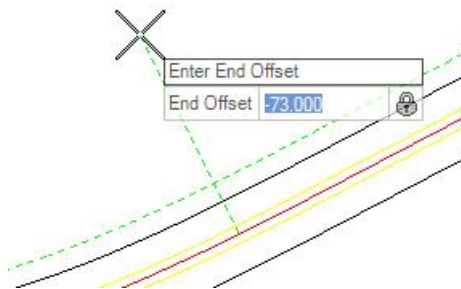


177. Now let's use the Arc Between Elements command to build an arc between this new arc and the mainline.

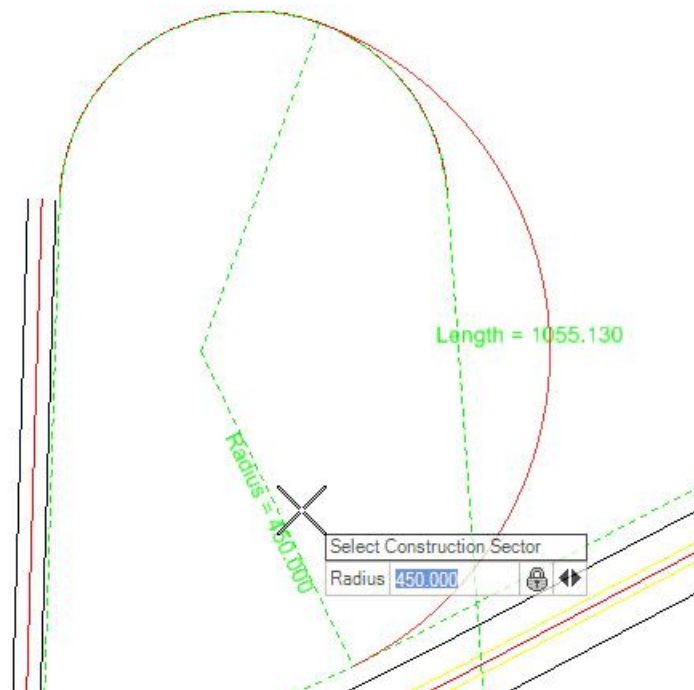
178. Use the arc we just created as back element with 0' offset.



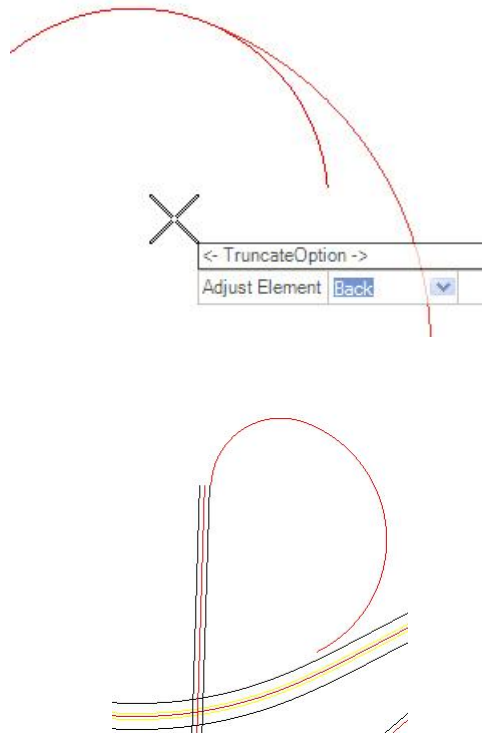
179. Use the Mainline as ahead element with 73' offset.



180. Use 450' radius.



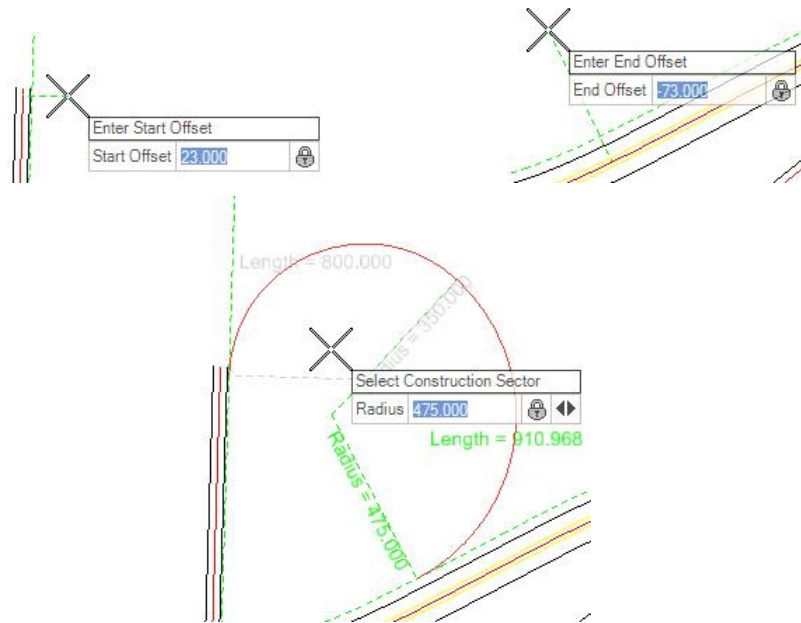
181. Trim the back element only.



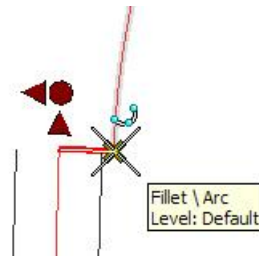
Question: *Is this a good design? You judge. Play with the radii and see if you can get a better solution.*

182. Perhaps we can use the Arc Between Elements command to construct the entire ramp in one operation. In addition to spiral transitions, the tool can create arc transitions as well, which allows you to create 2-center and 3-center curves.

Arc Between Elements	
<input checked="" type="checkbox"/> Radius	475.000
<input checked="" type="checkbox"/> Start Offset	23.000
<input checked="" type="checkbox"/> End Offset	-73.000
Loop	<input checked="" type="checkbox"/>
Back taper ▾	
Back transition ^	
Geometry	Curve ▾
Method	Length ▾
Radius	350.000
Length	800.000
Ahead taper ▾	
Ahead transition ▾	
Feature ▾	

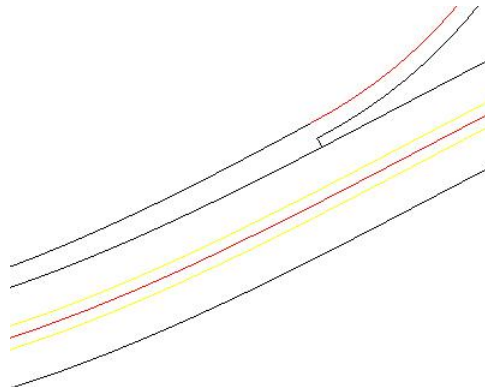


183. Since both base elements were offset we could not trim them. Zoom in close to the cross-road and notice that we need to drag the end point back to match the start of the ramp.

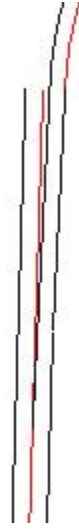


184. Now construct the ramp edge of pavement at 16' offset for entire length of the ramp.

185. Also, construct the 50:1 taper and gore same as we did on previous ramp.



186. We also need to construct and trim 30:1 tapers where the ramp joins the cross-road



Lesson Name: Outside Loop Ramp (Ramp Number 4)

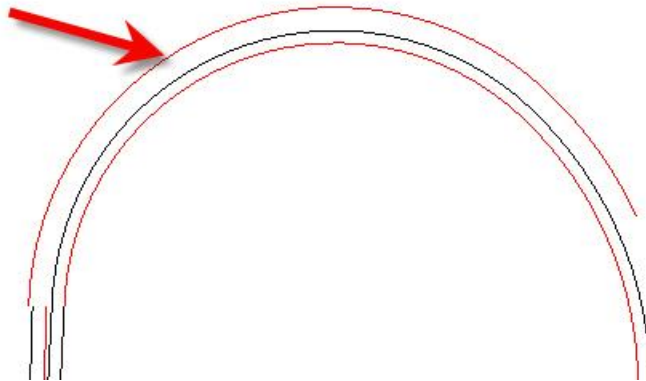
LESSON OBJECTIVE:

In this lesson we will construct the outside loop ramp and its edges of pavement.

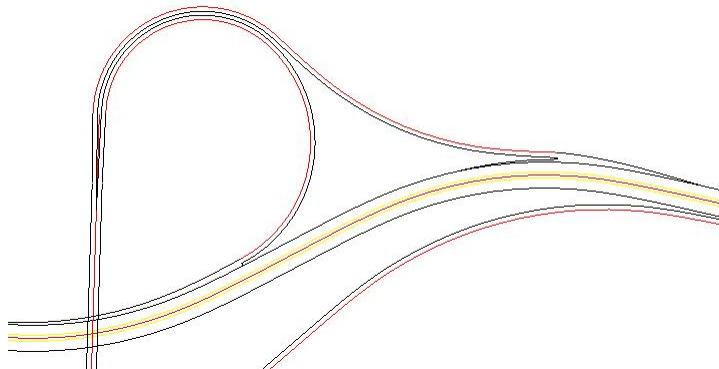
EXERCISE: CONSTRUCT THE OUTSIDE LOOP RAMP

The outside loop ramp will be parallel to the inside ramp for a portion of its length and will diverge from the mainline at a 15:1 taper.

187. We can construct a portion of the outside loop by offsetting the inside loop . Start the Offset Transition tool. The offset will be 46'. Limits will be from start of the inside ramp to about halfway round.



188. Now use what you have learned thus far to construct remainder of ramp, its edges of pavement and gore areas.



APPENDIX A: Feature Definitions

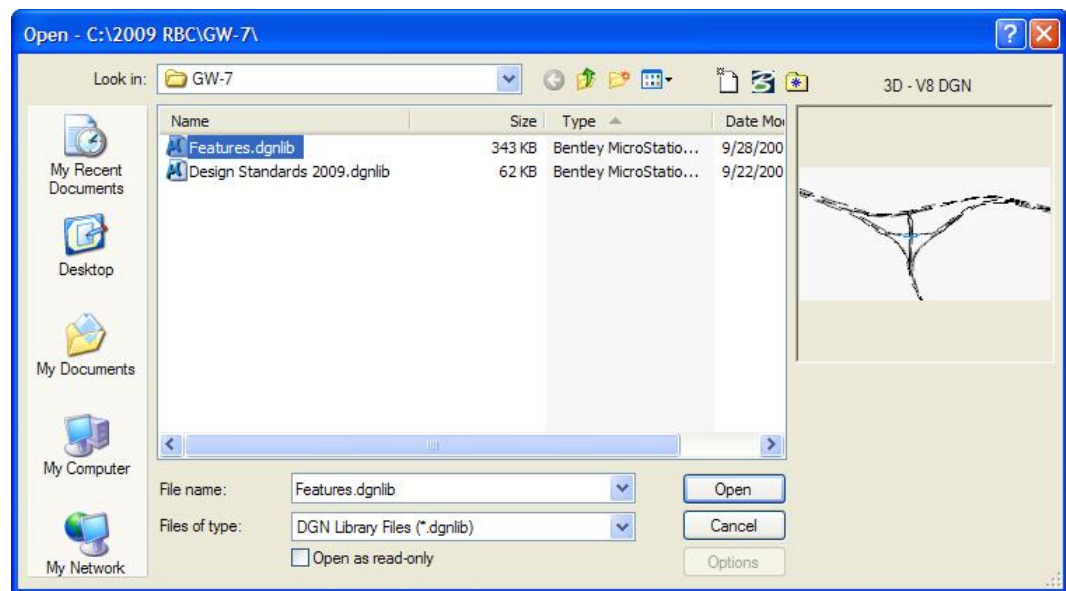
LESSON OBJECTIVE:

In this manual we used a prepared DGNLIB file which contained our feature definitions. This lesson shows how to create the DGNLIB using your preexisting DDB, XIN or PSS file. This example uses a GEOPAK D&C Manager (ddb) file for feature definitions but user can alternatively utilize an InRoads (XIN) file or an MX (PSS) file.

EXERCISE: CREATE A DGNLIB THAT CONTAINS OUR FEATURE DEFINITIONS

So that we can easily control symbology, annotation and quantities, we will create a feature definition table. The Civil Platform Geometry tools make use of your existing DDB, XIN or PSS feature definition table so that you do not have to recreate everything from scratch.

1. Open a blank DGNLIB file (or it might be one which contains some other settings and standards you use. **C:\2009 RBC\GW-7\Features.dgnlib**).

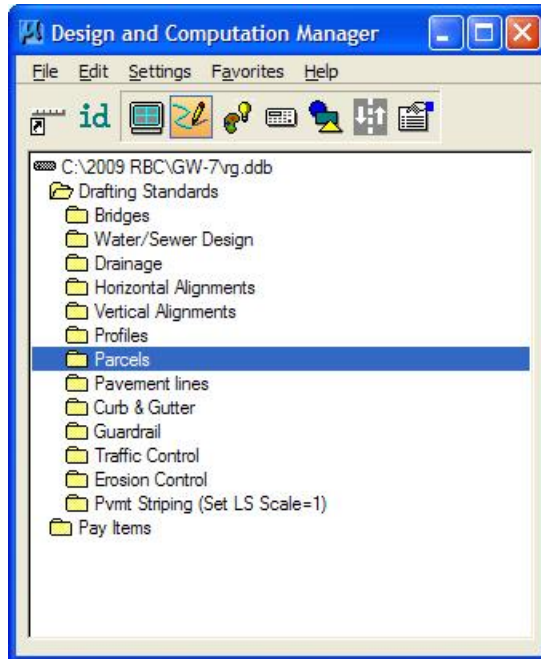


2. We will be using GEOPAK feature definitions in this exercise so let's first make sure that GEOPAK is active and InRoads is inactive. Go to Applications menu and activate GEOPAK



Note: the processes shown here are identical for InRoads and MX. The only differences would be that either InRoads or MX would be active instead of GEOPAK, and instead of using a DDB file you would use an InRoads XIN or MX PSS file

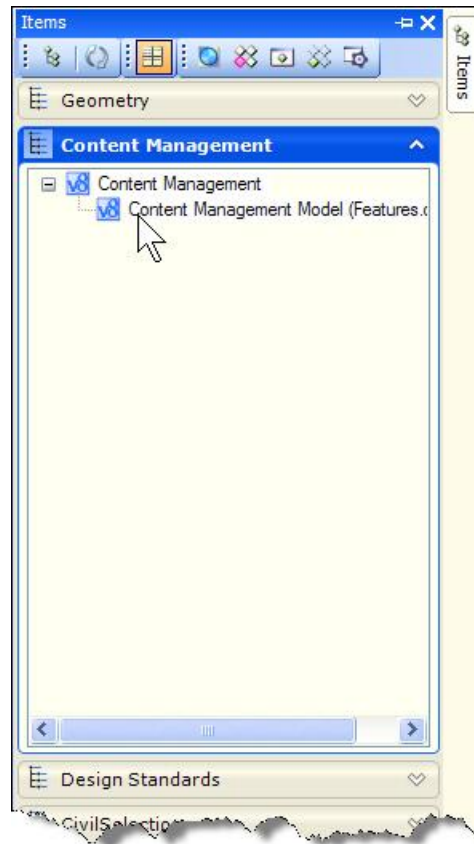
3. The Civil Platform tools work very closely with the native applications (MX, InRoads and GEOPAK) so we need to use GEOPAK's D&C Manager to open the DDB file we want first. Applications > GEOPAK > Road > Design and Computation Manager.



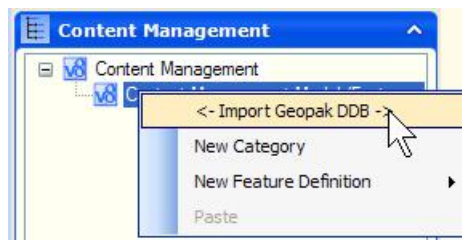
4. Now on this dialog open the DDB file shown. (File > Open > rg.ddb)

Note: This is the only time we will use any GEOPAK commands in this exercise.

5. Now, open the Items browser > Content Management panel and note that no feature definitions exist in this file.

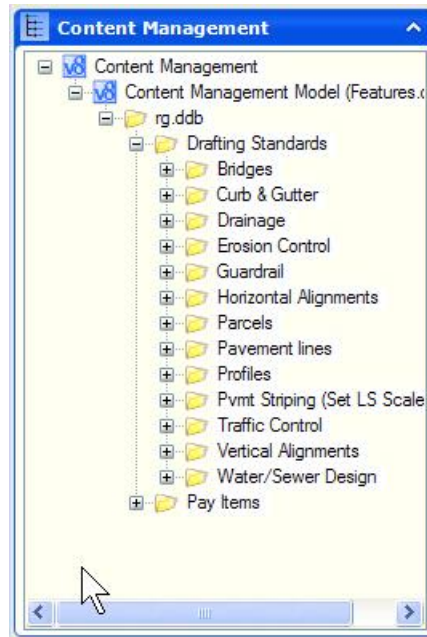


6. Right click on the Content Management Model line and choose Import DDB.



Note: For InRoads users this menu would read "Import InRoads XIN". For MX users it would read "Import MX PSS file"

7. The DDB file which is active (the one we just opened in GEOPAK) is now populated in the file.



8. Close Microstation and copy this file (Features.dgnlib) to C:\Program Files\BentleyV8i1\WorkSpace\Interfaces\MicroStation\default

Note: This is one of the default locations that Microstation searches for DGNLIB files. The user or administrator can set up any locations which is useful to the organization. The only requirement is that the location is included in the MS_DGNLIBLIST configuration variable.

Appendix B: Design Standards

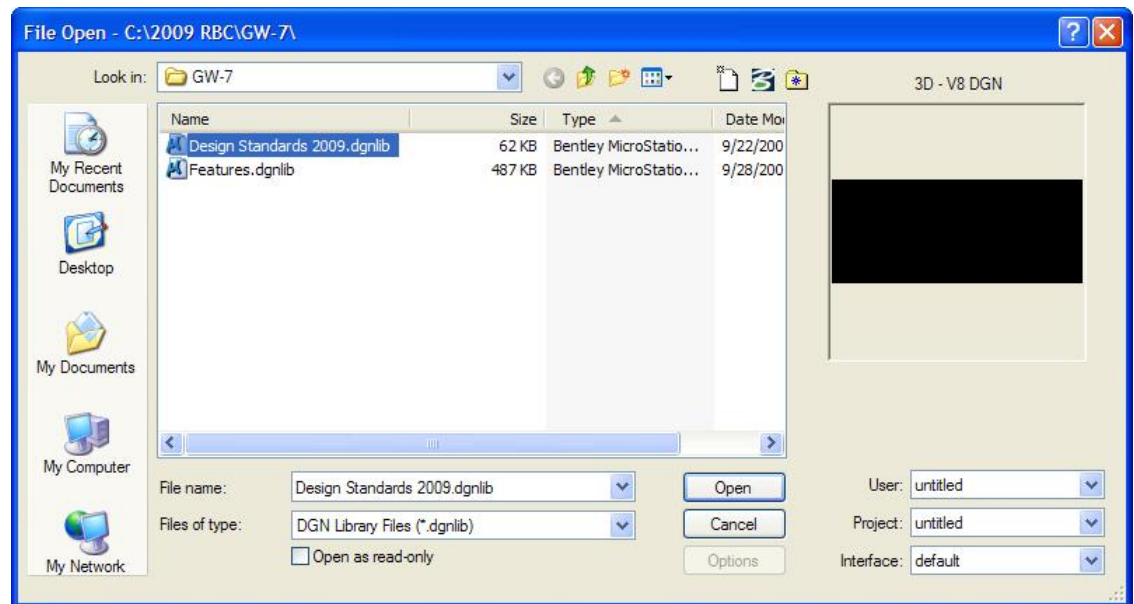
LESSON OBJECTIVE:

In this lesson we will review the design standards appropriate to this project and will go through the process of creating a new design standard.

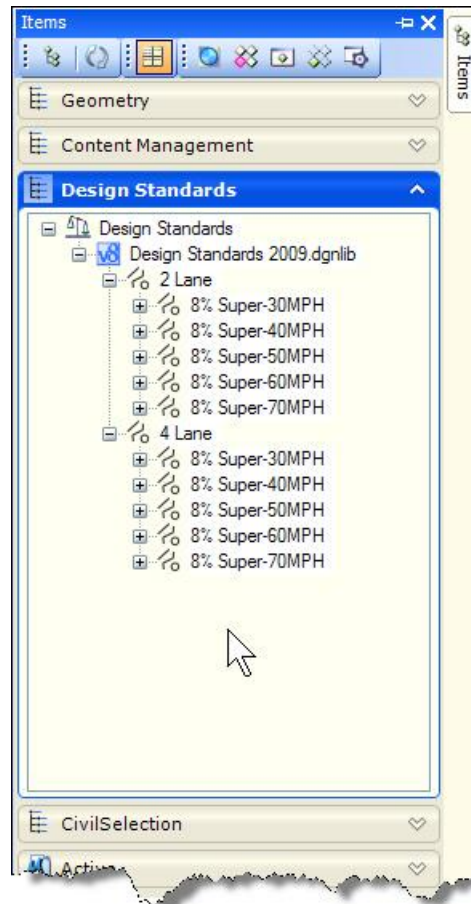
EXERCISE: INVESTIGATE THE DGNLIB THAT CONTAINS OUR DESIGN STANDARDS

Design Standards allow you to set up your organization's desired standards to control alignment configurations based on design speed and other considerations. For this release the standards are very much oriented towards alignments and control maximum/minimum radius and tangent lengths and also define required transition lengths.

1. Open a blank DGNLIB (or one which contains other standards that you use) **C:\2009 RBC\GW-7\Design Standards 2009.dgnlib**



2. Now, open the Items browser > Design Standards panel and note that the design standards which already exist.



3. Select the standard in 4 Lane group labeled 8% Super-70MPH

4. Open the details panel to review the settings.

The screenshot shows a 'Details' window with three expandable sections. The 'Arc Values' section is expanded, showing a table with four rows: Speed (70), Default Radius (2864.795), Minimum Radius (1909.859), and Transition Type (Table). The 'Complex Checks - Arcs' section is also expanded, showing a table with five rows: Insure Tangency Arc (True), Include Transitions To Arcs (True), Include Transitions To Tangents (True), Maximum Arc Length (100000.000), and Minimum Arc Length (500.000). The 'Complex Checks - Tangents' section is expanded, showing a table with five rows: Insure Tangency Tangent (True), Include Transitions (False), Maximum Tangent Length (100000.000), Minimum Tangent Length (100.000), and Maximum Deflection (1).

Arc Values	
Speed	70
Default Radius	2864.795
Minimum Radius	1909.859
Transition Type	Table

Complex Checks - Arcs	
Insure Tangency Arc	True
Include Transitions To Arcs	True
Include Transitions To Tangents	True
Maximum Arc Length	100000.000
Minimum Arc Length	500.000

Complex Checks - Tangents	
Insure Tangency Tangent	True
Include Transitions	False
Maximum Tangent Length	100000.000
Minimum Tangent Length	100.000
Maximum Deflection	1

5. The properties for each standard are:

Speed – this is the design speed for the standard. This is for user information and also used in equations.

Default Radius – this is the radius used to populate commands when they start.
(Note: Degree of curve input to the design standards settings are not supported at this time)

Minimum Radius – this is the minimum radius for the corresponding design speed. Utilizing values lower than this radius will cause a warning to be displayed.

Transition Type – can be by Table or Equation *(Note: For this release, the transition length equation is a hard coded equation as found in the AASHTO Manual 2004. This is the same formula used in the United Kingdom (perhaps elsewhere))*

Table – If transition type is table then this is used to populate the table. (See below)

Insure Tangency Arc – if True then the standard checks all arcs to insure against kinks.

Include Transitions to Arcs – If true then transitions are applied to arc commands.

Maximum Arc Length

Minimum Arc Length

Insure Tangency Tangent – If true then tangents are checked for kinks.

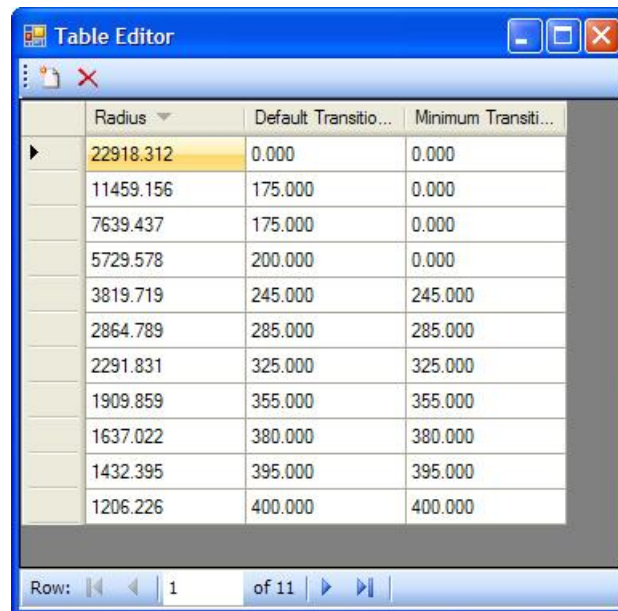
Include transitions – If true then line commands will have transitions added.

Maximum Tangent Length

Minimum Tangent Length

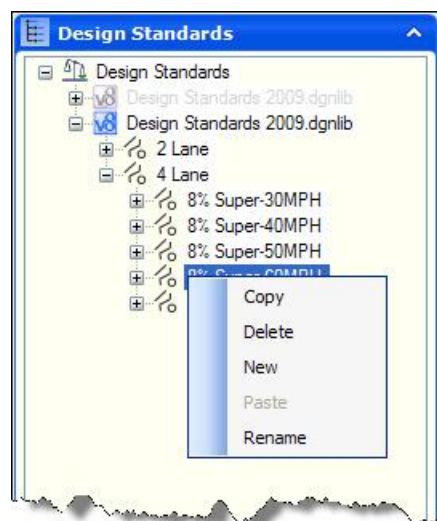
Maximum Deflection – Where two tangents join without a curve, what is the maximum angle between the lines.

6. Transition Tables – This is a radius table which list default and minimum transition lengths corresponding to each radius. If the actual used radius is not specifically found in the list then the transition length for the radius which is closest to but not longer than the specific radius is used.



	Radius	Default Transiti...	Minimum Transiti...
▶	22918.312	0.000	0.000
	11459.156	175.000	0.000
	7639.437	175.000	0.000
	5729.578	200.000	0.000
	3819.719	245.000	245.000
	2864.789	285.000	285.000
	2291.831	325.000	325.000
	1909.859	355.000	355.000
	1637.022	380.000	380.000
	1432.395	395.000	395.000
	1206.226	400.000	400.000

7. You can create a new standard by right click > New. Or by copy/paste of an existing standard.



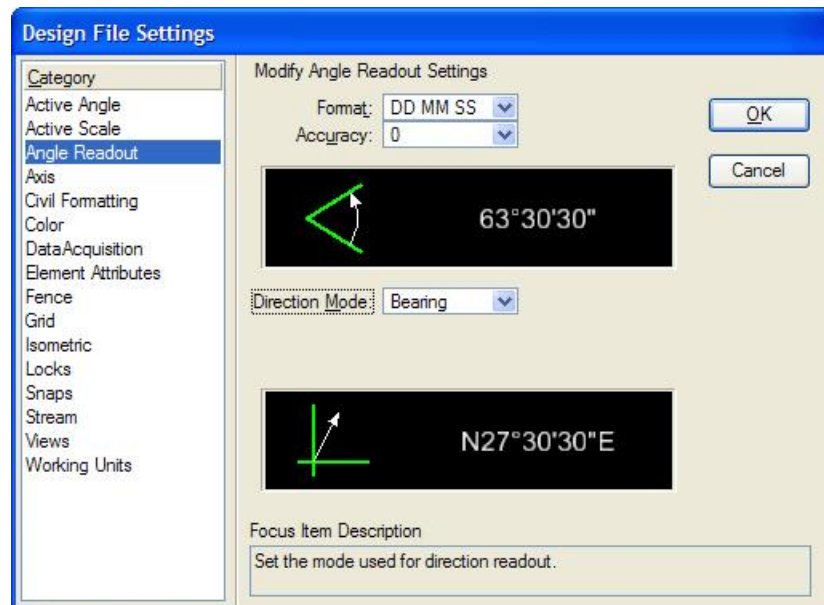
Appendix C: Civil Platform Settings

LESSON OBJECTIVE:

In this appendix we will review the settings which control the Civil Platform operation. Civil Platform utilizes settings from 2 different places; DGN settings and Workspace Preferences.

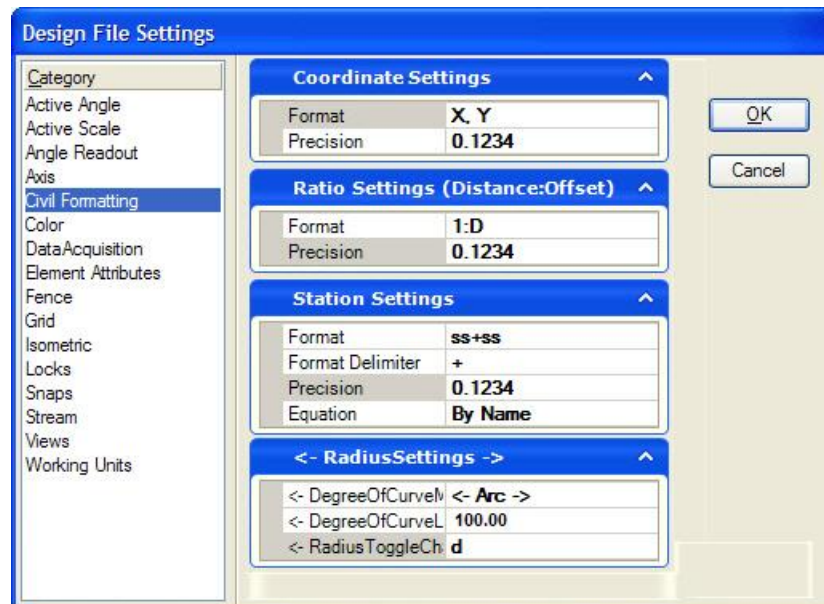
EXERCISE: INVESTIGATE THE DGN SETTINGS

1. Angle formats used by Civil Platform tools follow Angle Format Settings. These are same settings used by the rest of Microstation.



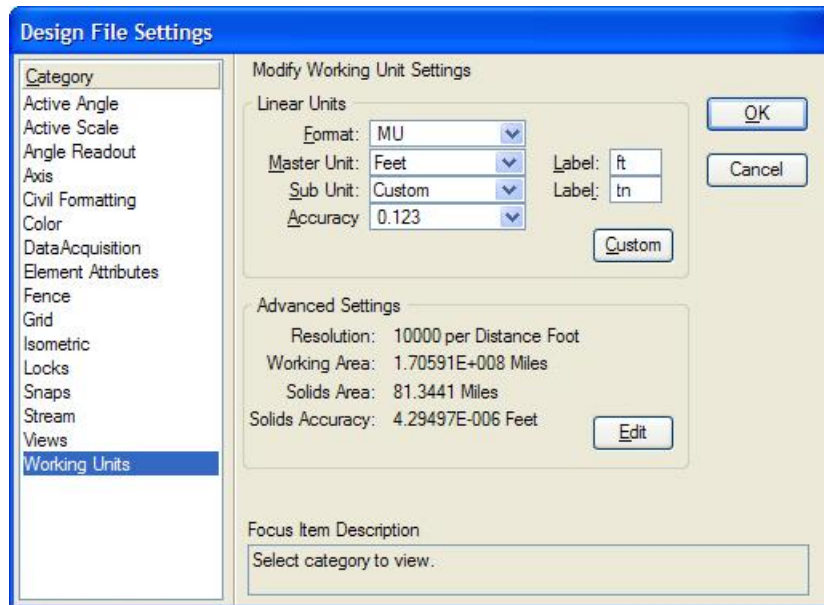
- Format: DD MM SS, DD.DDDD, DD MM, Gradians, Radians are all supported
- Direction Mode: Bearing and all formats of Azimuth are supported

- When Civil Platform is loaded then there is a new Civil Formatting panel of settings.



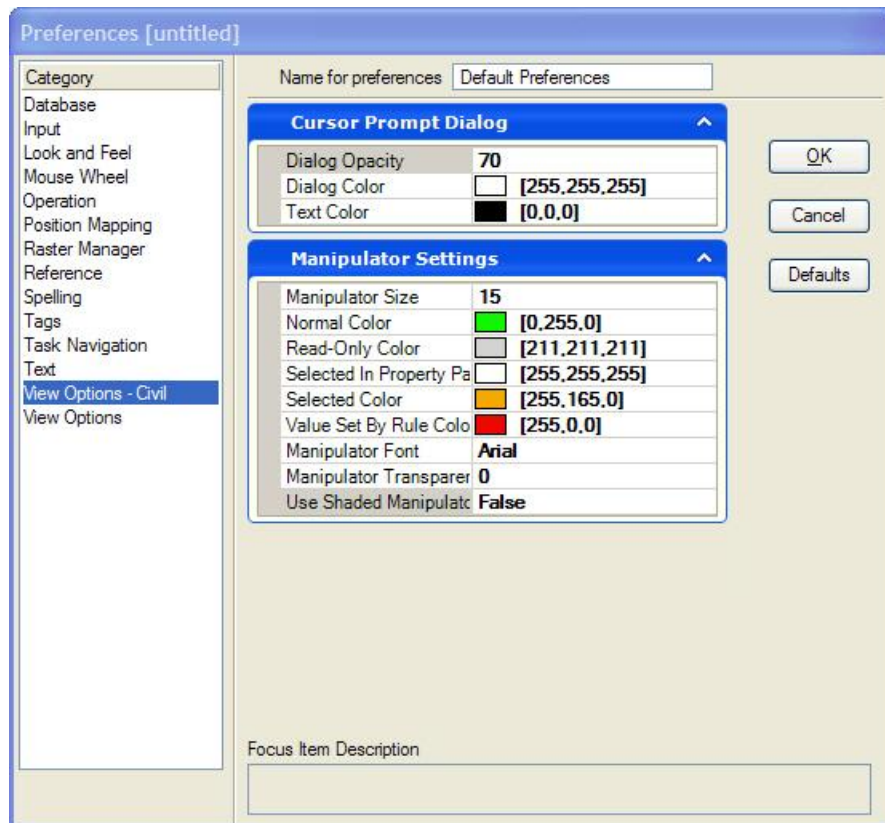
- Coordinate Format: X,Y or N,E
- Coordinate Precision: Number of decimal places shown on coordinates.
- Ratio Settings Format: 1:D form or D:1 form.
- Ratio Precision: Number of decimal places used on ratios.
- Station Settings Format: No delimiter, 2 digits after delimiter, 3 digits after delimiter
- Station Format Delimiter: Usually a plus sign
- Station precision: number of decimal places on delimiter
- Station Equation Type: By Name (InRoads compatible) or By Region (GEOPAK compatible)
- Radius Settings Degree of Curve: By Chord or By Arc
- Degree of Curve Length: Length of chord or arc used to define a 1 degree curve.
- Radius Toggle: the keystroke used to define degree of curve instead of radius in commands.

3. Working Units are used by Civil Platform to determine units and the precision is used for distances.



4.

5. When Civil Platform is loaded there is also an additional panel added to Workspace > Preferences.



6.

- Cursor Prompt Dialog – Settings to control the heads up prompt. These are used for commands and Civil Accudraw.

- Dialog Opacity – Set the opacity/transparency of the heads up prompt
- Dialog Color – The color of the heads up prompt window.
- Text Color – The text color used in the heads up prompt.
- Manipulator Settings –
 - Manipulator size – the size of manipulators. 10 is default. Smaller numbers translate to smaller manipulator size.
 - Normal Color – The color of manipulators which have not been locked by rule.
 - Read Only Color – Some manipulators are shown for information only. This is the color for those manipulators.
 - Selected in Property Pane – If use element information of a selected element then the manipulator corresponding to the property with focus is temporarily shown in this color.
 - Selected color – When you hover over or click on a manipulator it temporarily changes to this color.
 - Value set by rule – User input to commands will result in certain rules being defined for the element. A manipulator which is shown in this color is determined by rule and changing the value of the manipulator will result in a change in the rule.
 - Manipulator Font – The font used for text manipulators
 - Transparency – The transparency applied to manipulators
 - Use Shading – True uses a shaded pattern on the manipulators.